Pioneer Valley
WATER ACTION PLAN

Prepared by Pioneer Valley Planning Commission
in cooperation with Pioneer Valley Water Supply Task Force
June 1990

This project was funded in part through a Strategic Planning Grant from the
Massachusetts Executive Office of Communities and Development

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1.0 INTRODUCTION

1.1 Project Goals and Objectives

The Pioneer Valley Water Action Plan has been prepared to summarize the results of a nine-month regional water supply planning process undertaken by the Pioneer Valley Planning Commission, in cooperation with the Pioneer Valley Water Supply Task Force. The project was funded through a Strategic Planning grant from Massachusetts Executive Office of Communities and Development. Project goals and objectives are as follows:

a. Goals

1. To promote regional cooperation between Pioneer Valley communities on water demand management, water conservation and protection, and response to water emergencies;

2. To encourage water conservation practices in the Region's businesses, residences and public buildings.

b. Objectives

1. To assess municipal water supply adequacy and supply needs for Pioneer Valley communities through the Year 2000 and beyond;

2. To investigate the technical and legal mechanisms necessary to establish intermunicipal water supply connections in the Pioneer Valley;

3. To develop and implement a regional water demand reduction and conservation strategy;

4. To assess water use and promote water conservation practices in the region's businesses through education and technology transfer;

5. To investigate cooperative regional approaches to developing new supplies, protecting existing supplies, meeting state regulations, and utilizing state grants or resources.

1.2 Formation of Pioneer Valley Water Supply Task Force

In order to assist the Pioneer Valley Planning Commission in collecting water supply data, and in developing regional water supply strategies, the Pioneer Valley Water Supply Task Force was formed. The membership includes:

Pioneer Valley Water Task Force

Members

Christopher Golba, Senior Treatment Chemist, Chicopee Water Department
Francis Broderick, Director, Springfield Water Department
David Conti, Manager, Holyoke Water Works
John Higgins, Regional Engineer, Mass. Department of Environmental Protection
Peter McNulty, Acting Director, Northampton Department of Public Works
William Elliot, Director, Water Supply Citizens Advisory Committee

Members (Continued)

* Dennis Miles, Administrative Assistant, West Springfield
Barbara Swords, Westfield City Council
Stanley Ziomek, Assistant Town Manager, Amherst
John Pearsall, Planning and Community Development Administrator, Wilbraham
Edward Wroblewski, Water Superintendent, Hatfield
Michael Tautznik, Board of Selectmen, Easthampton
Jim Holeva, Metropolitan District Commission
John Stone, Superintendent of Public Works, Agawam
Donald Pipczynski, Board of Selectmen, Hadley

Associate Members

Lawrence Smith, Planning Department, Northampton
Stuart Beckley, Town Planner, Easthampton
Wayne Feiden, Planning Department, Northampton
Kurt Boisjolie, Mass. Department of Environmental Protection
Robert Hoyt, Springfield Water Department

Pioneer Valley Planning Commission Staff Members

Christopher Curtis
Thomas Matuszko
Francesca Maltese

* Denotes Task Force Chairman

1.3 Planning Process

The planning process for developing the Pioneer Valley Water Action Plan was divided into three components: 1) community involvement; 2) data collection and analysis; 3) policy and strategy development.

a. Community Involvement

The Water Supply Task Force served as the public advisory committee for the development of the Pioneer Valley Water Action Plan. The Water Supply Task Force convened its first meeting on December 1, 1989, and has met monthly since that time. The Task Force meeting agendas are summarized below.

Date	Meeting Location	Major Agenda Items
December 1, 1989	West Springfield	• Discussion of PVPC Work Plan • Task Force Goals and Objectives • Municipal and Business Water Surveys
January 9, 1990	Northampton	• Status of PVPC Data Collection/ Survey Results • MWRA Presentation: Chicopee Valley Aqueduct Study • State Plumbing Code Changes • New Chapter 361 Legislation

Date	Meeting Location	Major Agenda Items
February 20, 1990	Westfield	• Legislation Prohibiting Declining Block Rates • State Plumbing Code Changes • Formation of Subcommittees on Protection, Conservation, Intermunicipal Connections
March 6, 1990	Amherst	• Presentation on MWRA Water Conservation Program • Working Sessions: Policy Subcommittees
April 10, 1990	West Springfield	• Presentation on Barnes Regional Aquifer Protection • Working Sessions: Policy Subcommittees
May 8, 1990	Quabbin Reservoir	• Working Sessions: Policy Subcommittees • Full Task Force Adoption of Subcommittee Recommendations
June 11, 1990	Chicopee	• Release of Draft Water Action Plan • MWRA Report on Chicopee Valley Aqueduct Study

b. Data Collection and Analysis

Pioneer Valley Planning Commission provided staff support to the Task Force in completing data collection and analysis tasks.

PVPC developed a survey instrument designed to assess current municipal priorities for water supply management and demand reduction, to collect up-to-date information on water pricing policies, and water conservation regulations, as well as to determine level of support for various demand reduction strategies. The survey was administered by mail to each of the region's 43 municipalities, with follow-up phone calls to verify information. The resulting data was used to develop the community-specific water supply assessments in this report.

A second survey was developed and mailed to the region's 97 major employers (businesses over 250 employees). This survey assessed existing water conservation measures used in businesses, and willingness of businesses to retrofit conservation devices and measures. The resulting data is summarized later in this report.

The Water 2000 report (PVPC, 1987) provides a complete assessment of water supply availability and needs for the region. However, since Water 2000 data was collected in 1983, events have changed the region's water outlook. Concerns, such as the recent pollution of wells in Westfield, Southwick, Easthampton and Palmer, the uncertainty of continued availability of MWRA water for Wilbraham, Chicopee and South Hadley after contracts expire in the next decade, among others, have clouded the region's water supply situation. PVPC updated regional water supply and demand projections, based on current information, to provide an up-to-date assessment on which to base demand reduction strategies.

PVPC also developed detailed information on water conservation options, water supply protection options, and mechanisms for implementing intermunicipal connections.

c. Policy and Strategy Development

The Water Supply Task Force created three subcommittees to consider policy issues and to draft recommended regional strategies for water conservation, water quality protection, and intermunicipal connections. Task Force subcommittee membership is shown below.

Municipal Water Conservation Subcommittee

Donald Pipczynski	Larry Smith
Ed Wroblewski	Bill Elliot
Kurt Boisjolie	Chris Curtis

Water Quality Protection Subcommittee

Wayne Feiden	Donald Spencer
James Holeva	Barbara Swords
Mike Tautznik	Dennis Miles
	Francesca Maltese

Intermunicipal Connections Subcommittee

Fran Broderick	Peter McNulty
Stuart Beckley	John Pearsall
Stan Ziomek	John Higgins
Chris Golba	David Conti
Bob Hoyt	Tom Matuszko

Each subcommittee prepared a final report with recommendations which were adopted by vote of the full Task Force on May 8, 1990. The adopted subcommittee reports became the recommended water action strategies in this report.

2.0 REGIONAL WATER NEEDS FOR YEAR 2000 AND BEYOND

2.1 Summary of Regional Water Outlook

Pioneer Valley communities will be faced with increasing demands for limited water resources as we move into the 21st Century, due to regional growth pressures, loss of supplies due to pollution, and other water demands.

a. Source of Supply

The 43 communities of Hampden and Hampshire counties receive their drinking water from a variety of sources. Twelve municipalities supply all, or nearly all, of their residents from public water supply sources. These are Hadley, Northampton, Springfield, West Springfield, South Hadley, Agawam, Amherst, Chicopee, East Longmeadow, Easthampton, Holyoke and Longmeadow. For 7 of these 12 com-communities, Agawam, Chicopee, East Longmeadow, Holyoke, Longmeadow, Springfield and West Springfield, the source of supply is surface water from reservoirs. Many of these reservoirs are not located within the municipality receiving the supply. Two of these 12 municipalities, Easthampton and Hadley supply their residents entirely with groundwater. In 3 municipalities, Amherst, Northampton and South Hadley, the sources of supply are both groundwater and surface water.

Private on-site groundwater wells supply the residents of 11 towns. There are no central supply systems in the towns of Brimfield, Chesterfield, Goshen, Hampden, Holland, Middlefield, Montgomery, Plainfield, Tolland, Wales and Westhampton.

Varying proportions of residents in the remaining 20 municipalities are served by central supply systems with the remainder served by private on-site wells. The source of public supply for 6 towns, Belchertown, Cummington, Monson, Southwick, Ware and Granville is groundwater. Six additional towns receive public supplies from surface water reservoirs. These are systems in Blandford, Chester, Ludlow, Pelham, Wilbraham and Westfield. Residents in the remaining 8 towns, Granby, Hatfield, Huntington, Palmer, Russell, Southampton, Williamsburg and Worthington receive their water supply from both groundwater and surface water sources.

b. Changes in Supply 1980 - 1990

Contaminated or Closed Supplies

Chemical contamination has forced the closing of public wells in five Hampshire and Hampden County municipalities. Traces of trichlorethylene (TCE) were found in Easthampton's Hendrick Street well in 1985. The well is now only used during times of extreme emergency. The source of contamination has not been definitely determined. The well is being continuously pumped in attempts to draw out the contaminating material. Easthampton had adequate supplies from other in-town sources to replace the Hendrick Street well and meet demand.

Westfield's wells #3 and #4 have been closed since 1989 when traces of Ethylene dibromide (EDB) were found in the well water. West Springfield's Southwick wellfield was closed in 1984 due to EDB contamination. Westfield and West Springfield both had emergency interconnections with Springfield and were able to receive supplies with little disruption to their residents.

Palmer's Galaxy wellfield was closed in the early 1980's due to tetra-chloroethylene, trichloroethylene and 1,1,1, trichlorethylene. That wellfield is undergoing treatment and is expected to be operational in the early 1990's. Amherst's Brickyard well was contaminated in the early 1980's due to municipal landfill leacheate and has not been used. Recent well samples have met current EPA standards, however.

Other Closed Supplies

Holyoke, Northampton and Westhampton have removed supplies from use. Holyoke has capped the West Holyoke wellfield. The Pequot water supply wells in Holyoke, which were privately owned wells supplying a small number of households have also been capped due to contamination. West Holyoke residents are now supplied by Holyoke is reservoir system.

Northampton has taken the Roberts Meadow Reservoir Complex off line as a main supply because of the need for a treatment facility. Other surface water sources in Northampton are able to meet Northampton's demand. The privately owned Westhampton Water Company which served a small portion of Westhampton's population will no longer be in business due to the costs required to upgrade an old system and provide water filtration.

New Supplies

During 1980-88, the region's supplies have not greatly increased. New sources of supply have been developed in only three municipalities, Belchertown, Cummington and Ware.

Belchertown expects to bring the Daigle well on line after final Department of Environmental Protection (D.E.P.) approval is gained and a distribution line laid. Ware also is in the final stage of D.E.P. approval for its new well source located off Route 32. The Cummington Water Department recently brought its Cummington Center well on line.

Four communities, Amherst, South Hadley, Southwick and Williamsburg are in different stages of exploration for new supply sources.

c. Changes in Demand 1980 - 1990

The Pioneer Valley region's total water consumption increased 5% between 1980 and 1988. The total amount of water consumed in the 34 central water supply systems in 29 municipalities for which data was available in the region for 1988 was 33,775 million gallons, an increase of 1,506 million gallons over the 32,269.2 million gallons consumed in 1980.

Table 1. **1988 CENTRAL WATER SYSTEMS SUPPLY AND DEMAND**

Municipality	Source of Supply	1988 Safe Yield	1988 Total Consumption	1988 Average Day Demand	1988 Maximum Day Demand	1988 Surplus/ Deficit
Agawam	Springfield Regional Water System	--	1,163 mg	4.8 mgd	6 mgd	--
Amherst	Atkins Reservoir; Hill, Hawley and Intake Reservoir; South Amherst Well; Brown Well; Well #4	5.5 mgd	1,493 mg	4.1 mgd	5.8 mgd	-.2 mgd
Belchertown	Jensen St. Wellfield; Bardwell St. Wellfield	.43 mgd	84 mg	.23 mgd	.32 mgd	+.11 mgd
Blandford	Long Pond Reservoir	.5 mgd	56 mg	.15 mgd	.29 mgd	+.35 mgd
Brimfield	--	--	--	--	--	--
Chester	Horn Pond Reservoir; Austin Brook Reservoir	.18 mgd	38 mg	.10 mgd	.19 mgd	+.08 mgd
Chesterfield	--	--	--	--	--	--
Chicopee	Quabbin Reservoir (MWRA)	--	3,852 mg	10.5 mgd	17.3 mgd	--
Cummington						
Cummington Ctr.	Ballfield Well	Not Available	3.9 mg (1986)	.01 mgd (1986)	Not Available	Not Available
West Cummington	Wells (2)	.043 mgd	1.8 mg (1986)	.004 mgd (1986)	Not Available	Not Available
East Longmeadow	Springfield Regional Water System	--	639.5 mg	1.78 mgd	2.5 mgd	--

Municipality	Source of Supply	1988 Safe Yield	1988 Total Consumption	1988 Average Day Demand	1988 Maximum Day Demand	1988 Surplus/ Deficit
Easthampton	Hendrick Street Well; Pines Street Well; Nonotuck Park Well; Lovefield Street Well	6.5 mgd	963.6 mg	2.6 mgd	4.9 mgd	+1.6 mdg
Goshen	--	--	--	--	--	--
Granby	South Hadley Fire District #2	--	--	--	--	--
Granville	Granville Center Water Company 4 Springs, 1 Well	.02 mgd	.2 mg	550 gals/day		
Hadley	Mt. Warner Well (2) Callahan Well (2)	4.5 mgd	276.4 mg	.8 mgd	2.3 mgd	+2.2 mgd
Hampden	--	--	--	--	--	--
Hatfield	Running Gutter Brook Reservoir; Well #1; Omastar Well	.75 mgd	116.3 mg	.32 mgd	.75 mgd	+.43 mgd
Holland	--	--	--	--	--	--
Holyoke	Tighe-Carmody Reservoir; Ashley Pond Reservoir; McLean Reservoir; Whitney Street Reservoir	17.2 mgd	3,426 mg	10.2 mgd	13.6 mgd	+7.0 mgd
Huntington	Cold Brook Reservoir Huntington Wells #1 and #2	.54 mgd	46.7 mg	.13 mgd	.22 mgd	+.32 mgd
Longmeadow	Springfield Regional Water System	--	931 mgd	2.6 mgd	7.2 mgd	--

Municipality	Source of Supply	1988 Safe Yield	1988 Total Consumption	1988 Average Day Demand	1988 Maximum Day Demand	1988 Surplus/ Deficit
Ludlow	Springfield Water Department; Ludlow Reservoir	7 mgd	739.6 mg	2.0 mgd	6.3 mgd	+5 mgd
Middlefield	--	--	--	--	--	--
Monson	Wells #1,2,3	2.25 mgd	255.9 mg	.7 mgd	1.2 mgd	+1.05 mgd
Montgomery	--	--	--	--	--	--
Northampton	SP Ryan Reservoir; West Whateley Reservoir; Mountain Street Reservoir; Clark Street Wells (2); Spring Street Well	10.8 mgd	1,627 mg	5.4 mgd	6 mgd	+5.4 mgd
Palmer Palmer District #1 (Palmer Village)	Graves Brook Upper and Lower Reservoirs; Well #1; Well #2	1.1 mgd	240.4 mg	.65 mgd	1.2 mgd	-.1 mgd
Thorndike	Bondsville District	N/A	55 mg	.133 mgd	.193 mgd	--
Bondsville	Wells #1, 2, 3	.69 mgd	74.9 mg	.205 mgd	.539 mgd	+.15
Three Rivers	Wells #1, 2, 3	1.08 mgd	138.7 mg	.38 mgd	.54 mgd	+.54
Pelham	Town of Amherst	--	--	--	--	--
Plainfield	--	--	--	--	--	--
Russell	Black Brook Reservoir; Well #1	.55 mgd	152 mg	.42 mgd	.67 mgd	+.13 mgd

Municipality	Source of Supply	1988 Safe Yield	1988 Total Consumption	1988 Average Day Demand	1988 Maximum Day Demand	1988 Surplus/ Deficit
South Hadley District #1	MWRA (Quabbin Reservoir)	3.8 mgd	839.7 mg	2.3 mgd	3.9 mgd	+1.5 mgd
District #2	Lythia Spring Reservoir; Dry Brook Well; Elmer Brook Wells (2)	1.65 mgd	186 mg	.51 mgd	1 mgd	+.65 mgd
Southampton	Holyoke Water Works (Tighe-Carmody Reservoir) College Highway Well	.58 mgd	58 mg	.16 mgd	.21 mgd	+.42 mgd
Southwick	Well (1) Springfield Regional Water System	.72 mgd	182 mg	.5 mgd	.71 mgd	+.01 mgd
Springfield	Cobble Mt. Reservoir; Borden Brook Reservoir; Littleville Dam; Ludlow Reservoir	92 mgd	11,351 mg	42.6 mgd	76.5 mgd	+49.4 mgd
Tolland	--	--	--	--	--	--
Wales	--	--	--	--	--	--
Ware	Barnes Street Wellfield	1.24 mgd	393 mg	1 mgd	1.6 mgd	-.36 mgd
West Springfield	Springfield Regional Water System (Emergency Supply) Bear Hole Reservoir	1.25 mgd	1,653.5 mg	4.5 mgd	6.1 mgd	-3.25 mgd

Municipality	Source of Supply	1988 Safe Yield	1988 Total Consumption	1988 Average Day Demand	1988 Maximum Day Demand	1988 Surplus/ Deficit
Westfield	Springfield Regional Water System (Emergency Supply) Wells 1,2,5,6,7,8 Granville Reservoir System	11.0 mgd	2,255.2 mg	6.16 mgd	14 mgd	-3.0 mgd
Westhampton	--	--	--	--	--	--
Wilbraham	MWRA (Quabbin Reservoir)	--	417 mg	1.14 mgd	2.4 mgd	--
Williamsburg	Unquomonk Reservoirs; South Street Wells	1.27 mgd	55 mg	.15 mgd	.26 mgd	1.12 mgd
Worthington	Reservoirs #1, 2; Wells #2, 3, 4	1.46 mgd	12 mg	.03 mgd	.08 mgd	1.43 mgd

Demand Increases and Decreases By Community

Annual water consumption increased in 24 systems in 23 municipalities since 1980 while it decreased in 9 systems in 8 municipalities. The municipalities which have decreased water consumption are Chester, Easthampton, Hadley, Monson, Palmer (FD #1, Three Rivers), South Hadley (FD #2), Williamsburg and Worthington. The decrease in many of these municipalities could be due to a loss of industry or decline in farming.

Water consumption for the municipalities which receive water from the MWRA, Wilbraham, South Hadley (District #1) and Chicopee increased by 286.4 mg, a 6% increase from 1980 to 1988, from 4,822.35 mg to 5,108.7 mg.

Water consumption for the municipalities of Agawam, East Longmeadow, Longmeadow, Ludlow, Springfield, Southwick, West Springfield and Westfield, which receive water from the Springfield Regional Water System either through a regular, emergency or supplemental agreement increased by 1,872 mg, an 11% increase from 17,042 mg to 18,914 mg since 1980.

Reasons for Changes in Demand

The reasons for changes in water consumption are difficult to determine. Four important variables must be considered when discussing change in water consumption: 1) a change in the number of users; 2) a change in the amount used per user; 3) a change in the type of water consumption, either residential, agricultural, commercial or industrial; and 4) the amount of unaccounted for water. This project was limited in scope and unable to gather complete data for these four variables, the most notable deficiency in data gathering being the water consumption by type and unaccounted for water. However, three general trends can be assumed using the available data of population change, consumption change and employment change, as described below:

1) Water Consumption Based on Residential Growth

Change in water consumption as a result of population change could be assumed if the amount of population change was consistent with the change in total water consumption, and industrial consumption and per capita consumption was relatively constant. This is a typical case in many suburban municipalities, such as Belchertown which has a small manufacturing base, relatively constant per capita consumption, but which experienced water consumption and population increase.

2) Water Consumption Based on Industrial Change

Change in water consumption as a result of industrial use could be assumed if the change in consumption mirrored the change in industrial use and population was constant. This frequently occurs in older manufacturing towns which suffered a decrease in traditional manufacturing jobs such as Monson and Chester.

3) Water Consumption Based on Per Capita Use

Change in the amount of per capita consumption can be assumed if population and industrial use are relatively constant but water consumption has changed, which occurred, for example in East Longmeadow.

Most likely an explanation for the change in water consumption in most communities in the region depends on a combination of these variables, population change, per capita change, and change in use. Table 2 presents information on changes in water consumption, Table 4 presents changes in population and employment for the region for the years 1980 and 1988.

4) Unaccounted for Water

In those instances where there is not a consistent relationship between population change, change in per capita consumption, or change in use, it is possible there has been a large increase in the amount of unaccounted for water.

Regionwide Trends

In the Pioneer Valley region, the population served by the central systems in these municipalities increased from 528,539 in 1980 to 543,433 in 1988, an increase of 14,894 or 3%. Thus, at a regional level the increase in water consumption of 5% is somewhat disproportionately higher than the increase in population over this time frame.

Employment data for the Pioneer Valley region show a decrease of 28,470 manufacturing jobs between 1980 and 1988 from 124,863 to 96,393. As manufacturing jobs are a good indicator of manufacturing water use, it is likely that the increase in water consumption during 1980-1988 is not due to increased manufacturing use.

Per capita water consumption for the Pioneer Valley Region increased by 2% between 1980 and 1988 from 167 gallons per capita per day in to 170 gallons per capita per day. In addition to this region wide trend, per capita consumption increased in 16 water systems: Amherst, Blandford, Bondsville, Northampton, Russell, South Hadley District #2, Southampton, Ware, Wilbraham, East Longmeadow, Ludlow, Southwick, Longmeadow, Springfield, and West Springfield.

The increase in water consumption for the region is most likely a result of increased residential water use, both an increase in the amount of users and an increase in the amount used per person. If this is the case, it would support the need for greater conservation practices for residential users.

No clear regional trends emerge to explain the per capita increase in water consumption. In several communities an increase in use may have resulted from perceived abundance of supply (i.e. there is no need to conserve.) However, per capita consumption increased in Amherst and Ware which could both experience water shortfalls in long periods of high demand. Six of the systems where per capita consumption increased from 1980 to 1988 were part of the Springfield Regional System, which has an abundance of supply and until recently had a declining block rate structure.

Table 2. WATER DEMAND - 1980 AND 1988

	1980 Total Consumption (mg)	1988 Total Consumption (mg)	Change 80 - 88 (mg)	% Change	1980 ADD (mgd)	1988 ADD (mgd)	Change 80 - 88 (mgd)	1980 gpcd	1988 gpcd
Agawam	998.7	1,163.0	+164.3	+16%	2.74	3.19	+.45	106	104
Amherst	1167.0	1493.0	+326.0	+28%	3.20	4.09	+.89	98	124
Belchertown	72.9	84.0	+11.1	+15%	.20	.23	+.03	67	61
Blandford	28.9	56.0	+27.1	+94%	.08	.15	+.07	95	159
Chester	73.0 (Estimated)	38.0	-35.0	-48%	.20	.10	-.10	274	140
Chicopee	3717.0	3852.0	+135.0	+4%	10.18	10.55	+.37	185	185
Cummington									
Cummington Center	3.65	3.9 (1986)	+.25	+7%	.01	.01	0	36	32 (1986)
West Cummington	1.46	1.8 (1986)	+.34	+23%	.004	.004	0	36	36 (1986)
East Longmeadow	457.6	639.5	+181.9	+40%	1.25	1.75	+.50	100	130
Easthampton	1159.0	936.6	-195.4	-17%	3.18	2.64	-.54	206	163
Granby	Water consumption data not available.								
Granville	Water consumption data not available.								
Hadley	287.2	276.4	-10.8	-4%	.79	.76	-.03	191	176
Hatfield	102.2	116.3	+14.1	+14%	.28	.32	+.04	115	106
Holyoke	4523.0	3426.0	+1097.0	+24%	12.39	9.41	-2.98	283	224
Huntington	36.5 (Estimated)	46.7	+10.2	+28%	.10	.13	+.03	127	127
Longmeadow	750.3	931.0	+180.7	+24%	2.06	2.55	+.49	127	154

	1980 Total Consumption (mg)	1988 Total Consumption (mg)	Change 80 - 88 (mg)	% Change	1980 ADD (mgd)	1988 ADD (mgd)	Change 80 - 88 (mgd)	1980 gpcd	1988 gpcd
Ludlow	460.0	739.6	+279.6	+60%	1.26	2.03	+.74	87	132
Monson	344.8	255.9	-88.9	-26%	.94	.70	-.24	190	128
Northampton	1351.0	1627.0	+276.0	+20%	3.70	4.46	+.76	127	139 (1987)
Palmer									
FD #1	246.7	240.4	-6.3	-2%	.68	.65	-.03	124	113
Thorndike	55.0	55.0	0	0	.15	.15	0	110	104
Bondsville	65.7	74.0	+8.3	+13%	.18	.20	+.02	144	152
Three Rivers	147.4	138.7	-8.7	-6%	.40	.38	-.02	118	105
Russell	83.0	152.0	+69.0	+83%	.23	.42	+.19	188	299
South Hadley									
FD #1	799.35 (Estimated)	839.7	+40.4	+5%	2.19	2.30	+.11	183	173
FD #2	187.5	186.0	-1.5	-1%	.51	.51	0	112	115
Southampton	41.3	58.0	+16.7	+40%	.11	.16	+.09	68	88
Southwick	131.4 (Estimated)	182.0	+50.6	+39%	.36	.5	+.14	97	121
Springfield	10594.0	11351.0	+757.0	+7%	29.0	31.0	+2.0	191	207
Ware	355.0	393.0	+38.0	+10%	.97	1.08	+.11	116	140
West Springfield	1412.0	1653.0	+241.0	+17%	3.87	4.53	+.66	143	169
Westfield	2238.0	2255.0	+17.0	+1%	6.13	6.18	+.05	183	174
Wilbraham	306.0	417.0	+111.0	+36%	.84	1.14	+.30	98	119
Williamsburg	58.8	55.0	-3.8	-6%	.16	.15	-.01	144	126
Worthington	13.8	12.0	-1.8	-13%	.04	.03	-.01	78	63

Data Sources: PVPC Water 2000
D.E.P. Community Public Water Supply Statistics

Water rate structure has not greatly influenced per capita water consumption. Three of the systems where per capita consumption has increased have declining block rates and four have an annual flat rate structure, eight have uniform block rates, and one has an increasing block rate.

d. Projected Water Demand 1990 - 2010

Projections are useful planning tools which allow governments the ability to meet anticipated future needs of their residents. However, water demand projections are difficult to make given the large number of social, economic, and political variables involved. Projections are most useful if they are used to identify broad trends rather than focus on specific details.

Projection Methodologies Investigated

Several projection methodologies were examined for this study to develop water demand projections for the region's municipalities. A computer model, IWR-MAIN, Water Use Forecasting System version 5.1, developed by the U.S. Army Corp. of Engineers was researched. Projections were studied as developed by the Metropolitan District Commission, Massachusetts Department of Environmental Management, Division of Water Resources and Metropolitan Area Planning Council.

The most reliable methodologies to determine water demand are those that use a disaggregate approach. These models separate water consumption by use into three main categories: residential, industrial; and public or unaccounted for water consumption (i.e. leaks). Several practical difficulties were encountered when this methodology was explored. Reliable water consumption data by use and reliable population and economic projections were unavailable for the municipalities.

Projection Methodology Used

Therefore, a simplified projection methodology was employed for this study. It used an aggregate demand for two time periods, determined an average per capita day demand (either based on 1988 ADD or if 1988 ADD decreased then an average of 1980 and 1988 ADD) assumed constant per capita consumption, then multiplied the present per capita consumption by population change. Population change was determined by using existing population projections. A further methodology description is in the appendix.

There are several obvious deficiencies with the approach. It does not disaggregate demand, does not use economic factors for projections, and does not use consistent population projection sources. The Pioneer Valley Planning Commission is in the process of developing reliable population and economic projections for the region. It is anticipated these new projections will be used in the future by the Pioneer Valley Water Supply Task Force to develop more sophisticated demand projections.

Summary of Demand Projections

Although based on a simplified projection methodology, the water demand projections (contained in Table 3.) illustrate trends worthy of noting. The following systems will be experiencing a projected deficit, or near deficit by the year 2010, if development continues along historical lines, and if no corrective action is taken:

Municipality/Water Systems	Reason for Projected Deficit in 2010
Amherst	Maximum daily demand will exceed safe yield, and community is more than 50% groundwater dependent
Easthampton	The community is totally dependent on groundwater. A current source of supply, the Hendrick Street Wellfield, may be unavailable for use due to contamination.
Hatfield	The community is more than 50% groundwater dependent. Maximum day demand is projected to exceed safe yield.
Palmer-District #1	The system is more than 50% groundwater dependent. Maximum day demand is projected to exceed safe yield.
South Hadley-District #1	The system is allowed to pump 3.8 mgd. from the Chicopee Valley Aqueduct. The maximum day demand is projected to exceed that amount.
Southwick	The community is totally dependent on groundwater. The maximum day demand is projected to exceed the safe yield.
Ware	The community is totally dependent on groundwater. The new well supply is expected to increase the safe yield from 1.24 mgd. to 1.8 mgd. The maximum day demand is projected to exceed that increased safe yield.

Westfield	Westfield already has a water supply deficit because of the loss of supply sources due to contamination. Without correction of the contamination that deficit will continue.
West Springfield	West Springfield has a deficit supply because of the loss of a supply source due to contamination. Without correaction of the contamination that deficit will continue.

It will be important, particularly for these water systems, to begin developing plans to augment their supply sources, and to more actively promote water conservation.

Table 3. Supply and Demand Projections

	1995 Safe Yield	1995 Population Served	1995 ADD (mgd)	1995 MDD (mgd)	2000 Population Served	2000 ADD (mdg)	2000 MDD (mgd)	2010 Population Served	2010 ADD (mgd)	2010 MDD (mgd)
Agawam	--	34,430	3.60	6.77	37,923	3.96	7.46	47,852	5.00	9.41
Amherst	5.50	34,470	4.26	6.04	35,113	4.34	6.15	37,237	4.60	6.53
Belchertown	.93	4,465	.28	.40	4,956	.32	.44	5,195	.33	.46
Blandford	.50	1,016	.16	.30	1,116	.18	.33	1,353	.22	.41
Chester	.18	763	.11	.20	833	.12	.21	984	.14	.25
Chicopee	--	57,350	10.59	17.36	60,522	11.17	18.30	65,029	12.00	19.67
Cummington										
Cummington Center		416	.01	.01	384	.01	.01	474	.02	.02
West Cummington	.043	168	.006	.006	156	.006	.006	192	.007	.007
East Longmeadow	--	14,133	1.83	3.66	16,320	2.12	4.23	19,274	2.50	5.00
Easthampton	6.50	16,668	3.08	5.71	17,130	3.16	5.87	18,421	3.40	6.31
Granby					Water Consumption Data Not Available.					
Granville					Water Consumption Data Not Available.					
Hadley	4.50	4,532	.53	2.52	4,630	.85	2.58	5,050	.93	2.81
Hatfield	.75	3,201	.35	.83	3,325	.37	.87	3,685	.41	.96
Holyoke	17.20	40,127	10.18	14.70	40,295	10.22	14.76	40,631	10.30	14.88
Huntington	.54	1,095	.14	.24	1,111	.14	.24	1,271	.16	.28
Longmeadow	--	16,430	2.53	7.13	17,666	2.72	7.66	18,940	2.91	8.21
Ludlow	7.00	15,425	2.04	6.35	17,229	2.28	7.09	19,487	2.58	8.02
Monson	2.25	5,500	.88	1.50	6,069	.97	1.66	6,982	1.11	1.91
Northampton	10.08	32,068			32,967	4.68	6.28	34,116		
Palmer										
FD #1	1.1	5,918	.67	1.22	6,046	.68	1.25	6,528	.74	1.35
Thorndike	--	1,479	.15	.20	1,511	.16	.20	1,632	.17	.22
Bondsville	.69	1,356	.21	.55	1,385	.21	.56	1,496	.23	.60
Three Rivers	1.08	3,698	.39	.55	3,779	.39	.56	4,080	.43	.61
Russell	.55	1,397	.42	.67	1,560	.47	.75	1,775	.53	.85
South Hadley										
FD #1	3.8	13,734	2.45	4.15	14,406	2.57	4.35	16,161	2.88	4.88
FD #2	1.65	4,578	.53	1.03	4,798	.55	1.08	5,380	.62	1.22
Southampton	.58	1,971	.17	.23	2,157	.19	.25	2,609	.23	.30
Southwick	.72	4,259	.51	.73	4,916	.59	.84	5,937	.72	1.02
Springfield	92.0	148,571	30.74	55.35	150,662	31.17	56.13	149,281	30.88	55.61
Ware	1.8	8,600	1.20	1.79	8,234	1.15	1.71	9,127	1.28	1.90
West Springfield	8.75	26,383	4.46	6.01	28,008	4.73	6.38	28,812	4.87	6.56
Westfield	11.0	35,997	6.42	14.54	41,034	7.31	16.57	47,273	8.43	19.09
Wilbraham	--	9,580	1.14	2.40	10,803	1.29	2.71	12,273	1.46	3.08
Williamsburg	1.27	1,332	.17	.29	1,315	.17	.28	1,478	.19	.32
Worthington	1.46	664	.04	.08	725	.05	.08	786	.05	.09

Table 4. Changes In Population/Employment 1980 - 1988

	1980 Population	1988 Population	1980 Population Served	1988 Population Served	% Population Change	1980 Total Employment	1988 Total Employment	% Employment Change
Agawam	26,271	30,808	25,746	30,500	18%	6,532	7,904	21%
Amherst	33,229	33,773	32,564	33,098	2%	10,423	11,072	6%
Belchertown	8,339	10,510	3,002	3,784	26%	2,139	2,798	31%
Blandford	1,038	1,210	830	968	17%	72	109	51%
Chester	1,123	1,270	730	737	1%	210	113	-46%
Chicopee	55,112	57,200	55,112	57,143	4%	17,302	18,539	7%
Cummington	657	800			22%	81	126	55%
Cummington Center			276	336	22%			
West Cummington	657	800	112	136	21%			
East Longmeadow	12,905	13,636	12,518	13,500	8%	6,932	7,939	15%
Easthampton	15,580	16,160	15,424	16,160	5%	4,423	4,957	12%
Hadley	4,125	4,300	4,125	4,300	4%	2,629	3,374	28%
Hatfield	3,045	3,157	2,436	2,999	23%	630	1,039	65%
Holyoke	44,678	42,000	43,784	42,000	-4%	23,656	25,659	8%
Huntington	1,804	1,980	1,046	1,010	-3%	328	393	20%
Longmeadow	16,301	16,768	16,138	16,600	3%	2,599	3,093	19%
Ludlow	18,150	19,140	14,520	15,312	5%	3,648	4,299	18%
Monson	7,315	8,000	4,974	5,440	9%	1,548	1,239	-20%
Northampton	29,286	30,486	29,257	30,456	4%	14,256	18,362	26%
Palmer	11,389	12,120			6%	6,043	6,820	13%
Palmer Village			5,467	5,818	6%			
Thorndike			1,367	1,454	6%			
Bondsville			1,253	1,333	6%			
Three Rivers			3,417	3,636	6%			
Russell	1,570	1,680	1,209	1,394	15%	536	637	19%
South Hadley	16,399	17,696			8%	4,570	4,937	8%
FD #1			11,807	13,274	12%			
FD #2			4,592	4,424	-4%			
Southampton	4,137	4,610	1,655	1,798	9%	407	778	91%
Southwick	7,382	8,820	3,691	4,140	12%	1,115	1,788	60%
Springfield	152,319	150,320	152,319	150,320	-1%	84,250	88,676	5%
Ware	8,593	9,630	8,416	7,704	-8%	2,418	2,435	1%
West Springfield	27,042	26,798	27,042	26,798	-1%	13,933	17,183	23%
Westfield	36,465	38,650	33,548	35,558	6%	15,999	16,410	3%
Wilbraham	12,053	12,720	8,558	9,578	12%	3,355	3,355	0
Williamsburg	2,237	2,400	1,119	1,200	7%	572	549	-4%
Worthington	932	1,250	485	525	8%	115	211	83%

Data Sources: Department of Environmental Protection, Community Public Water Supply Statistics
Department of Employment and Training, Employment and Wages in Massachusetts' Cities

2.2 Summary of Regional Water Pricing Policies

a. Type of Pricing Policy

There are five types of pricing policies for the municipalities in Hampden and Hampshire Counties. They are: No municipal or central supply charges, residents are responsible for the full cost for their individual water supply; annual flat rate; increasing block rate; uniform block rate; declining block rate.

1. No charges: Brimfield, Chesterfield, Goshen, Hampden, Holland, Middlefield, Montgomery, Plainfield, Tolland and Wales.

In municipalities without a central water supply system, residents are not assessed a yearly or per unit charge. Each user assumes the total costs for the development management and operation of the individual supply.

2. Unmetered Flat Rate: Blandford (residential), Chester, Cummington, Granville (combined with a uniform block rate), Hadley (residential), Hatfield (residential), Huntington, Russell, Southampton, Westfield (residential), Westhampton, Williamsburg (combined with a uniform block rate), and Worthington.

An unmetered flat rate is a uniform amount charged to all services or service type usually based on a three-month, six-month, or yearly billing basis without regard to the amount of water used.

3. Increasing Block Rate: Wilbraham

The increasing block rate establishes an increase in the per unit price for water as the consumption increases.

4. Uniform Block Rate: Amherst, Belchertown, Easthampton, Granby, Granville (combined with unmetered flat rate), Hadley (commercial, new construction), Hatfield (commercial), Longmeadow, Ludlow, Northampton, Palmer, Pelham, South Hadley District #2, Southwick, Springfield, Ware, Williamsburg (combined with an unmetered flat rate).

The uniform block rate establishes a standard per unit price for water regardless of consumption.

5. Declining Block Rate: Agawam, Blandford (commercial), Chicopee, East Longmeadow, Holyoke, Monson, South Hadley District #1, West Springfield and Westfield (commercial and industrial)

A declining block rate establishes a per unit price for water which decreases as water consumption increases.

b. Full Cost Billing

All of the region's water systems have established water rates which charge users the full cost of water delivery and system maintenance except Hadley. Hadley still uses revenue from the general fund to pay for water delivery.

c. Enterprise Accounting

Enterprise accounts, which reserve water revenue for the water department, have been established in the following municipalities: Agawam, Amherst, Belchertown, Blandford, Chicopee, Cummington Center, West Cummington, East Longmeadow, Easthampton, Hadley, Hatfield, Holyoke, Northampton, Palmer - FD #1, Palmer - Three Rivers, South Hadley - Fire District #2, Southampton, Southwick, Springfield, Westfield and Wilbraham.

d. Metering

Meters have been installed in 100% of the services in sixteen central supply systems: Agawam, Amherst, Belchertown, Chicopee, Cummington Center, West Cummington, East Longmeadow, Easthampton, Holyoke, Longmeadow, Ludlow, Palmer - Fire District #1, Palmer - Three Rivers, South Hadley Fire District #1 and Fire District #2, Springfield, Ware, West Springfield and Wilbraham.

Meters have been installed in over 90% of the services in five communities: Monson, Northampton, Palmer - Bondsville, Palmer - Thorndike, Russell and Southwick.

The following ten communities have public water supply systems, but have not established universal metering: Blandford, Chester, Granville, Hadley, Hatfield, Huntington, Southampton, Westfield, Williamsburg and Worthington.

Table 5. WATER PRICING STRUCTURE AND RATES (as of January 1990)

COMMUNITY	PRICE STRUCTURE	RATES	
		1989 UNMETERED FLAT RATE	1989 BLOCK RATE (Per 1000 cubic feet)
Agawam	Declining Block Rate	----	$13.60 up to 10,000 cu ft. $11.80 10,000 to 50,000 cu. ft. $7.60 over 50,000 cu. ft.
Amherst	Uniform Block Rate	----	$13.00/1,000 cu. ft.
Belchertown	Uniform Block Rate	----	$19.50/1,000 cu. ft.
Blandford	Unmetered Flat Rate (res) Declining Block Rate (com)	$100/yr	$ 75 minimum $21.02 up to 2674 cu. ft. $12.56 2674 - 5348 cu. ft. $6.66 over 5348 cu. ft.
Brimfield	No Charges		
Chester	Unmetered Flat Rate	$84/yr	----
Chesterfield	No Charges		
Chicopee	Declining Block Rate		$7.50 up to 150,000 cu. ft. $3.30 150,000 - 1 million cu. ft. $1.50 1 million - 4 million cu. ft.
Cummington	Unmetered Flat Rate (over 2,000 cu. ft./6 mo a uniform block rate)	$105/yr	$16.00/1,000 cu. ft.
E. Longmeadow	Declining Block Rate		$13.00 for first 20,000 cu. ft. $12.00 20,000-60,000 cu. ft. $11.00 over 60,000 cu. ft.
Easthampton	Uniform Block Rate		$6.50/1,000 cu. ft.
Goshen	No Charges		
Granby	Uniform Block Rate		$8.50/1,000 cu. ft.
Granville	Unmetered Flat Rate Uniform Block Rate Over 1,000 cu. ft.	$100/yr	
Hadley	Unmetered Flat Rate (res) Uniform Block Rate (com ind. & new construction)	Based on # and type of fixtures	$7.50/1,000 cu. ft.
Hampden	No Charges		
Hatfield	Unmetered Flat Rate Uniform Block Rate (com)	$120/yr	$9.50/1,000 cu. ft.
Holland	No Charges		

COMMUNITY	PRICE STRUCTURE	RATES	
		1989 UNMETERED FLAT RATE	1989 BLOCK RATE (per 1000 cubic feet)
Holyoke	Declining Block Rate		$10.47 0-500,000 cu. ft. $9.72/500,000-1 million cu. ft. $ 8.97/1 million-5 million cu. ft. $ 8.23/ over 5 million cu. ft.
Huntington	Unmetered Flat Rate	$102 yr. (res) $158 yr. (com)	
Longmeadow	Uniform Block Rate		$ 9.80/1,000 cu. ft.
Ludlow	Uniform Block Rate		$10.90/1,000 cu. ft.
Middlefield	No Charges		
Monson	Declining Block Rate (minimum yearly charge)	$35.00/yr	$5.61 0-4011 cu. ft. 5.23 next 6,685 cu. ft. 4.49 next 26,740 cu. ft. 3.73 next 26,740 cu. ft. 2.99 next 53,480 cu. ft.
Montgomery	No Charges		
Northampton	Uniform Block Rate		$8.50/1,000 cu. ft.
Palmer			
Palmer Village Thorndike	Uniform Block Rate		$48/1,000 cu. ft
Three Rivers Bondsville	Uniform Block Rate		$20/1,000 cu. ft.
Pelham	Uniform Block Rate		$13.00/1,000 cu. ft.
Plainfield	No Charges		
Russell	Unmetered Flat Rate	$33/quarter	
So. Hadley District 1	Declining Block Rate		$10.00 minimum up to 1,200 cu. ft. $ 7.00 1,200-4,000 cu. ft. $ 5.40 over 4,000 cu. ft.
So. Hadley District 2	Uniform Block Rate		$8.50/1,000 cu. ft.
Southampton	Unmetered Flat Rate	$64/6 months	
Southwick	Uniform Block Rate		$9.34/1,000 cu. ft.
Springfield	Uniform Block Rate (wholesale rate for large users)		$10.90/1,000 cu. ft./ for first 20,000 cu. ft./quarter $3.30/1,000 cu. ft over 20,000 cu. ft./quarter
Tolland	No Charges		
Wales	No Charges		
Ware	Uniform Block Rate		$12.50/1,000 cu. ft.
West Springfield	Declining Block Rate		$ 5.00 0 - 2,000 cu. ft. 7.00 2,000 - 20, 000 cu. ft. 6.50 20,000 - 100,000 cu. ft. 5.50 over 100,000 cu. ft.

COMMUNITY	PRICE STRUCTURE	RATES	
		1989 UNMETERED FLAT RATE	1989 BLOCK RATE (per 1000 cubic feet)
Westfield	Unmetered Flat Rate (res) Declining Block Rate	Based on # and type of fixtures	$9.00 up to 50,000 cu. ft. $7.00 50,000-1 million cu. ft. $5.00 over 1000,000 cu. ft.
Westhampton	Unmetered Flat Rate	$104/yr	
Wilbraham	Increasing Block Rate		$ 7.50 0 - 10,000 cu. ft. $10.00 10,000 - 20,000 cu. ft. $12.50 over 20,000 cu. ft.
Williamsburg	Unmetered Flat Rate Uniform Block Rate	$60/yr & Cost/fixture	$7.50/1,000 cu. ft.
Worthington	Unmetered Flat Rate	$100/yr(res) $150/yr (com)	

Data Sources: Local Water Supply Officials
Department of Environment Protection, Community Public Water Supply Statistics

2.3 Summary of Existing Municipal Water Conservation Programs

The following section summarizes existing municipal water conservation programs, zoning regulations or building requirements to conserve water, and leak detection programs. This data is based upon a survey of municipal water departments and superintendents.

a. Zoning Regulations or Building Requirements

None of the region's municipalities have adopted zoning laws specifically targeted to conserve water. Several communities have adopted site plan review bylaws or cluster development bylaws, both of which could promote a decrease in net water consumption. However, the main purposes for the adoption of these two zoning laws have been to promote desired aesthetic controls and to conserve open space.

None of the region's municipalities have zoning laws or building requirements requiring mandatory recycling of industrial/commercial cooling or process water.

None of the region's municipalities have zoning laws or building requirements which require non-potable wells for outdoor or process water use for large commercial/industrial users.

b. Community Conservation Programs

The municipalities of Amherst, Belchertown, Chicopee, Hadley, Palmer - Three Rivers, South Hadley - District #1 and District #2, Southwick, Springfield and Williamsburg have instituted some type of water conservation program.

Amherst actively encourages water conservation, promotes the distribution of water saving devises and includes a public education brochure on water conservation with their bill.

Belchertown, Hadley, Palmer - Three Rivers, Springfield and Williamsburg encourage the use of water saving devices by residential users through various means.

Belchertown, Chicopee, Palmer - Three Rivers, South Hadley - District #1 and District #2, Southwick, Springfield and Williamsburg send users public education brochures on water conservation with their water bills.

Easthampton provides information on water loss and the cost of leaks; Holyoke is working on a public education program to reduce illegal fire plug use during summer months. Worthington provides a water conservation bulletin on the town bulletin board. Chicopee recently completed a comprehensive drought contingency plan.

None of the regions municipalities have undertaken a comprehensive program to replace plumbing fixtures in municipal buildings and schools with water conserving devices (i.e. water conserving toilets).

Amherst, Brimfield, Chesterfield, Hadley and Springfield have replaced some fixtures with water conserving devices in some municipal buildings and schools, mostly as on an as needed basis.

c. Leak Detection Programs

Programs for regular leak detection have been established in Amherst, Belchertown, Chicopee, Cummington Center, West Cummington, Holyoke, Ludlow, Palmer (District #1, Three Rivers, Bondsville, Thorndike), Southampton, South Hadley (District #1 and District #2) and Springfield.

The municipalities of Agawam, Amherst, Cummington, Holyoke, Ludlow, Palmer (District #1, Three Rivers), South Hadley (District #1 and District #2) and Springfield own their own leak detection equipment.

Water officials for the municipalities of Amherst, Chicopee, East Longmeadow, Hadley, Hatfield, Huntington, Palmer (Three Rivers), Southampton, Wilbraham, Williamsburg and Worthington support a shared purchase and use of leak detection equipment with neighboring municipalities.

3.0 COMMUNITY-BY-COMMUNITY WATER SUPPLY ASSESSMENTS

3.1 MUNICIPAL WATER SUPPLY SUMMARIES

The following section provides a town-by-town summary of the current water supply situation for each of the 43 cities and towns in the Pioneer Valley region. Each municipal summary contains data on:

- Sources of supply
- Water demand
- Pricing policy
- Protection strategies
- Conservation programs/regulations
- Leak detection
- Intermunicipal connections

AGAWAM

Sources of Supply

The Water Division of the Agawam Department of Public Works serves approximately 30,500 people, 99% of the Town's population, with water purchased from the Springfield Regional Water System. The remainder of the population receives its water from individual on-site wells. This Springfield water is supplied via interconnections with the Springfield Aqueduct. Studies done in the 1960's revealed while there was a potential for a groundwater supply, the poor quality of the water would require substantial treatment.

Agawam contracts with Springfield to purchase its water supply. These contracts typically had been multi-year (3 year). Agawam is currently in the process of renewing its contract. The most recent contract set a price of $400/mg. The new contract price will likely show an as-yet undetermined increase.

Water Demand

1988 Total Water Consumption: *1,163 mg.*
1988 Safe Yield: *NA*
1988 Average Day Demand : *4.8 mgd.*
1988 Maximum Day Demand: *6.0 mgd.*

Agawam's safe yield is directly linked with the safe yield of Springfield's System.

Previous contracts with Springfield did not set a limit to the amount of water Agawam could purchase from Springfield. The new contracts may include an additional cost to cover Springfield's costs incurred if increased demands cause an overdraw from Springfield's safe yield amount.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	26,271	25,746	106	2.74	4.40	--[1]
1988	30,808	30,500	104	3.19	6.00	
1995	34,478[2]	34,430	104	3.60	6.77	
2000	38,306	37,923	104	3.96	7.46	
2010	48,336	47,852	104	5.00	9.41	

[1] There is no contractual upper limit from the Springfield Regional System.
[2] The 1995 population project is based on a straight line increase only.

Pricing Policy:

Water Pricing Policy: *Declining Block Rate - Billing period: 6 months*
Water Rate: *$13.60/1000 cu. ft. for the first $10,000 cu. ft.*
$ 11.80/1000 cu. ft for the next 40,000 cu. ft.
$ 7.60/1000 cu. ft. over 50,000 cu. ft.

Agawam charges water uses through a declining block rate. One hundred percent of the 8,446 services are metered. The price structures reflect the full cost of water. An enterprise account has been established. The are no future plans to change the Town's water policy. A price increase was last instituted in 1987. A price increase may be needed to cover the increased cost of supply from Springfield. Meters are replaced as needed, primarily to allow outside meter reading.

Protection Strategies

Water Supply Zoning: *Not Applicable*
Land Acquisition Strategy: *Not Applicable*

Agawam depends on the Springfield Water Department to protect its water supply.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*
New State Plumbing Cost Enforcement: *Actively enforced*

Agawam does not promote water conservation and believes water conservation decreases needed water revenues. The new state plumbing code is actively enforced. Water-saving plumbing fixtures have not been replaced in any municipal buildings.

Leak Detection

Leak Detection: Not actively pursued

Agawam owns its own leak detection equipment but does perform a regular leak-detection program. The amount of water unaccounted for in 1988 was 150 mg, thirteen percent of the water purchased from Springfield.

Intermunicipal Connections

Agawam has 128 miles of main 4" or greater. It abuts 5 other municipalities with central supply systems; Southwick, West Springfield, Springfield, Westfield, and Longmeadow. There are 7 road junctions along its town boundaries. The Springfield Aqueduct goes through the town. Agawam is connected to the Springfield Aqueduct in six locations, each with a meter pit.

There are no existing emergency connections. There are potential road connections sites between Southwick at the Barry Street- Longyard Road junction and Southwick Street -Hills Road junction; Westfield at North Westfield Street-Feeding Hills Road; and West Springfield at Suffield Street-Memorial Avenue and Bridge Street. The Southwick-Barry Street and West Springfield-Suffield Street junction show the most potential. The Barry Street site needs a line extension by Agawam but Southwick's 8" line extends to the town line. The West Springfield-Suffield Street site has a 20" line in Agawam. The greatest limitation to the use of these potential sites is the uncertainty of supply in Southwick, Westfield and West Springfield. All three municipalities receive supplemental supplies from the Springfield Regional System.

Regular Connections:

Permanent long term:	Springfield -	North Westfield Street North Street Line Street Cooper Street Main Street Ellison Avenue
Emergency Connections:	None	
Potential Connections:	West Springfield - Suffield Street/Memorial Avenue Southwick - Barry Street/Long Yard Road	

Water Emergencies:

Agawam relies entirely on the Springfield Regional System and does not have other emergency plans.

Future Needs:

Agawam needs improvements to its distribution system to enlarge the South Main Street main to the Connecticut line.

AMHERST

Sources of Supply

The Amherst public water supply system, owned and operated by the Amherst Water Department, serves 98% of the town's population. The remaining 2% of the population is served by individual on-site wells. The University of Massachusetts, including that portion that is located in the Town of Hadley, is also served by the Amherst Water Department, as are several businesses in Hadley on the town line. In addition, residences in Pelham and Belchertown that adjoin pipelines from Amherst water supply sources in those towns are served by the Amherst system.

Type/Name	Location	Capacity	Safe Yield
Atkins Reservoir	on Cushman Brook Shutesbury	200mg	.90 mgd
Hill, Hawley & Intake	on Amethyst Brook Pelham	42mg	.90 mgd
South Amherst Brown Well #3	Lawrence Swamp Basin	----	1.00 mgd
	Lawrence Swamp Basin gravel packed Belchertown	----	1.30 mgd
Well #4 gravel packed	Lawrence Swamp Basin South Amherst	----	1.40mgd
Total:			5.5

The actual safe yield of the Atkins Reservoir is 1.2 mgd, but the present transmission line limits flow to .9 mgd. Well #5 in the Lawrence Swamp can only be pumped for short periods of time at a safe yield of .5 mgd. Therefore, this well is only used for backup supply. Finally, Amherst has the Brickyard Well with a safe yield of .4 mgd. This well is located off Belchertown Road and has not been in use since the early 1980's due to contamination from the Town's old landfill. However, recent well water samples have met current EPA standards and it is possible that the well could be used as a back-up supply in the future.

Water Demand

1988 Total Water Consumption:	*1,493.2 mg*
1988 Safe Yield:	*5.5 mg.*
1988 Average Day Demand:	*4.1 mgd.*
1988 Maximum Day Demand:	*5.8 mgd.*

In 1988 the total water consumption was 1,493 mg, with an average daily consumption of 4.1 mg. The date of maximum daily consumption in town was in mid-June when 5,798,300 gallons were used. This represents an increase of 41.7% over average daily consumption and is above the safe yield of the system. The difference between maximum day demand and safe yield is expected to be .65 mgd. by the year 2000.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	33,229	32,564	98	3.20	5.80	4.1
1988	33,773	33,098	124	4.09	5.80	5.5
1995	35,174	34,470	124	4.26	6.04	5.5
2000	35,830	35,113	124	4.34	6.15	5.5
2010	37,997	37,237	124	4.60	6.53	5.5

44,497 = Total population which could be served by 1988 safe yield

Pricing Policy

Water Pricing Policy: *Uniform Flat Rate*
Water Rate: *$13.00/1000 cu.ft*
Sewer Rate: *$ 9.00/1000 cu.ft*

Amherst residents are billed at a uniform rate of $1.30 per 100 cubic feet for water and $.90 per 100 cubic feet for sewer. This price structure reflects the full cost of water. An enterprise account has been established. Meters have been installed on 5,244 of the 5,294 services (99%).

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Adopted*

The Town of Amherst owns several hundred acres of watershed land, and the Zoning bylaw delineates both Watershed Protection and Aquifer Recharge Protection Overlay Districts. These overlay districts are designed to protect the quality and quantity of water in the watershed and aquifer recharge areas. The preservation techniques include the restriction of certain kinds of dumping and storage of hazardous materials, the use of sodium chloride for ice control, and the diversion of water.

Amherst also has acquired land to protect its water supplies.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Adopted*
New State Plumbing Code Enforcement: *Actively enforced*

Although not specifically adopted for water conservation, Amherst has adopted site plan review regulations that encourage small lawns and native landscaping, and has also adopted cluster residential zoning with provisions for smaller lawns. Several cluster developments exist in Amherst.

In addition, Amherst has developed an effective conservation program that includes public education brochures, water audits, and the distribution of water saving devices to residences.

Amherst actively enforces the new plumbing code requiring low-flow shower heads and water conserving toilets, and has replaced outdated fixtures in some municipal buildings.

Leak Detection

Leak Detection Program: Actively pursued

Amherst has developed an on-going process of leak detention and repair, and is in the process of purchasing leak detection equipment. In addition, the town has a capital improvement program to replace a percentage of the piping system each year.

Intermunicipal Connections

Amherst has 112 miles of main 4" or greater. While it abuts 7 other municipalities only 3 have central systems, Hadley, Belchertown and Sunderland. There are 13 road junctions with these three towns. Lines extend in Amherst to the town boundary or in close proximity (less than 500') in 8 locations with these three towns.

Amherst supplies a small portion of Pelham from the Hill, Hawley and Intake Reservoir, a small portion of Belchertown from the Brown well and a small number of businesses along Rt 9 in Hadley.

There is an existing emergency connection to Hadley at Meadow Street and Roosevelt Street. This was used in the early 1980's to supplement Amherst's supply. There is no formal agreement between the towns.

There are potential road connection sites with Hadley at Russellville Road-Comins Road, Northampton Street-Russell Street, North Hadley Road, Amity Street-Rocky Hill Road, Hadley Road-Mill Valley Road, West Bay Road-Bay Road. The sites with the most potential are Northampton Street-Russell Street and West Bay Road-Bay Road. The other sites need a long line extension. The Hadley Road site has a small pipe size in Hadley.

There are potential road connection sites with Sunderland along Rte 116 and Plumtrees Road. The Rt 116 site requires a line extension from Amherst. The Plumtrees Road site requires a line extension from Sunderland up a steep slope.

There are potential road connection sites with Belchertown at Rt 9, Station Road-North Street, Orchard Road, Bay Road. None of these sites offer good potential as Belchertown's lines are only concentrated in the town center. When the Daigle well is connected an inter-connection at that site would be promising.

Regular Connections:

Existing service arrangements:	Pelham Belchertown Hadley - Route 9
Emergency Connections:	Hadley - Meadow St.
Potential Connections:	Hadley - Rt 9 West Bay Road Sunderland-Rt 116 Belchertown - Rt 9

Water Emergencies:

The Town has an emergency connection to Hadley. There is no back up or redundant supplies to use in case of emergency.

Future Needs:

Based on projected population growth, Amherst will need additional supply to meet water demand by the year 2000. The Town is currently requesting permission from the Department of Environmental Protection to develop Well #6. In addition, a treatment facility for the Atkins Reservoir supply is needed, and, after the development of Well #6, additional treatment capacity will be needed there. A new transmission line will be needed on South East Street in the near future.

BELCHERTOWN

Sources of Supply

The Belchertown Water District serves approximately 3000 people, about 29% of the Town's population. About 1% of the population is served by Amherst's Brown Well. The Belchertown State School supplies those at the State School. The remaining population is served by individual on-site wells. The following sources are used:

Type/Name	Location	Capacity	Safe Yield
Jensen Street and	Jabish Brook	-	
Bardwell St Wellfields	Jabish Brook	-	
(19 wells total)			.43 mgd (combined)

Belchertown has recently developed the Daigle Well in the north end of town off Old Federal St. This well is now undergoing final stages of D.E.P. approval. 1.5 miles of line need to be installed to connect the source with the main distribution system. The Daigle Well safe yield is .5mgd.

Belchertown is seeking to change the 19 individual point source wells to 4 larger wells to install submersible pumps. This conversion would reduce operating costs. The existing point source wells would become a back-up supply source. This process is undergoing D.E.P. approval.

The Belchertown State School operates a wellfield consisting of 36 wells with a safe yield of .30 mgd, also located on Jabish brook about 2,000 ft. downstream from the District source.

Water Demand

1988 Total Water Consumption:	*84 mg*
1988 Safe Yield:	*.43 mgd.*
1988 Average Day Demand:	*.23 mgd*
1988 Maximum Day Demand:	*.32 mgd*

Belchertown currently has a surplus of .11 mgd. The surplus is expected to be .49 mgd in the year 2000. The new Daigle well will increase Belchertown's surplus. However, much of the new supply from Daigle well is expected to be consumed by the approximately 150 new services which are expected to be connected once the well is operational.

The future closing of Belchertown State School and the possible conversion of that site to a more intense use could have a great impact on the water demand. The current State School water system is in need of improvement.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	8,339	3,002	67	0.20	0.28	0.43
1988	10,510	3,784	61	0.23	0.32	0.43
1995	12,404	4,465	64[2]	0.28	0.40	0.93 [3]
2000	13,767[1]	4,956	64	0.32	0.44	0.93
2010	14,431	5,195	64	0.33	0.46	0.93

6753 = Total population which could be served by 1988 safe yield

[1] The year 2000 population projection is based on a straight line increase only.
[2] The projected ADD is based on an average of 1980 and 1998 gpcd.
[3] The 1985 safe yield reflects the Daigle well on line.

Pricing Policy:

Water Pricing Policy: *Uniform Block Rate*
Water Rate: *$19.50/1000 cu. ft./Billed Quarterly*

Belchertown charges $19.50/1000 cu. ft. through a uniform block rate structure. Nearly 100% of the 538 services are metered. The price structure reflects the full cost of water. An enterprise account has been established.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Adopted*

Belchertown has adopted an Aquifer protection district. The Town is in active negotiation to acquire land surrounding the Daigle wellfield and presently owns 14 acres around the existing wellfields. A low salt policy has been adopted on Rts. 202 and 9 to protect private wells. A previous salt storage facility has been removed near the Jensen St wellfield.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*
New State Plumbing Code Enforcement: *Actively enforced*

Belchertown has not adopted specific zoning regulations to conserve water. The new state plumbing code is actively enforced. Belchertown actively encourages the use of water saving devices in the home and periodically sends information about water conservation with water bills.

Leak Detection

Leak detection: *Actively pursued*

Belchertown purchased leak detection equipment 2 years ago and pursues an active leak detection program. The savings resulting from the leak detection program have already paid for the cost of the equipment. 28.8 mg, 30% of the Town's yearly consumption, are reported unaccounted for.

Intermunicipal Connections

Belchertown has 11 miles of main 8" or over. It abuts 4 towns with central water supply systems: Amherst, Ludlow, Palmer and Ware. There are 12 road junctions with these towns at the town boundaries. The Chicopee Valley Aqueduct is located in the town. Belchertown's distribution system is located around the town center, along Rtes. 9 & 21. In only one instance are the distribution lines less than 1 mile to another supply system.

There is a regular connection with the Amherst system in the northwest section of town. A small percentage of Belchertown's population is supplied by the transmission line from Amherst's Brown well.

There are no existing intermunicipal emergency connections. Belchertown does have an emergency interconnection with the Belchertown State School, which has its own water supply. That supply, however, is unpredictable.

Potential emergency interconnections are somewhat limited without a great expenditures to extend water mains. The greatest potential exists with Amherst in the Brown Well area. Belchertown needs to extend water mains from the Daigle Well to the present distribution system. When it does so it will be in close proximity to the Amherst lines to the Brown Well.

Regular Connections:
Existing Service Agreement: Amherst - Amherst Rd.

Emergency Connections:
Temporary Short-term Connection: Belchertown State School

Potential Connection: Amherst - Old Federal Street

Water Emergencies:

Belchertown needs to complete the process of connecting the Daigle well. The high volume of unaccounted for water should be accounted for. The future use of the Belchertown State School needs to be planned for as soon as possible to allow for infrastructure planning.

BLANDFORD

Sources of Supply

The Town of Blandford supplies water to approximately 80% of its estimated 1,200 residents. The remainder of the population is supplied from on-site wells. The following source is used.

Type/Name	Location	Capacity	Safe Yield
Long Pond Reservoir	Off Gibbs Road	Unavailable	.5 .5

Water Demand

1988 Total Water Consumption: *56.3 mg.*
1988 Safe Yield: *.5 mgd.*
1988 Average Day Demand: *.15 mgd.*
1988 Maximum Day Demand: *.29 mgd.*

Blandford currently has a surplus of .35 mgd. Maximum day demand is well below the safe yield. The surplus is expected to be .34 mgd by the year 2000.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	1,038	830	95	0.08	0.10	0.5
1988	1,210	968	159	0.15	0.29	0.5
1995	1,270	1,016	159	0.16	0.30	0.5
2000	1,395	1,116	159	0.18	0.33	0.5
2010	1,692	1,353	159	0.22	0.41	0.5

3,138 = Total population which could be served by 1988 safe yield

Pricing Policy

Water Pricing Policy: *Unmetered Flat Rate for residential use*
Declining Block Rate for commercial use

Water Rate: *$100 yr. for residential use*
$ 75 yr. for seasonal use

Commercial Rates:

$2.81 0-20,000 gallons
$1.68 20,000-40,000 gallons
$ .89 over 40,000 gallons
$ 75 minimum charge

Blandford has two different pricing policies, one for residential, one for commercial. Residential users are charged at a flat rate, commercial users are charged at a declining block rate at the rates listed above. None of the 255 residents services are metered, all of the commercial services are. The pricing structure reflects the full cost of delivery of water. An enterprise account has been established. There are no immediate plans to change the pricing policy.

Protection Strategies

Water Supply Zoning: *Not Adopted*
Land Acquisition Strategy: *Not Applicable*

The Long Pond Reservoir is within the watershed for Springfield's Cobble Mountain Reservoir. Springfield owns the land surrounding Long Pond and restricts the use of the property.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*
New State Plumbing Code Enforcement: *Partially enforced*

Blandford has not adopted specific zoning regulations to conserve water. The new state plumbing code requiring water conserving fixtures is only enforced some of the time. There are no water conservation programs within the community and water conserving plumbing fixtures have not been replaced in any municipal buildings.

Leak Detection

Leak detection: *Not actively pursued*

Blandford does not own leak detection equipment, has not developed a leak detection program and does not have plans to develop one in the near future.

Intermunicipal Connections

Blandford has 10 miles of main 8" or over. It abuts 3 towns. Chester, Huntington and Russell with central water systems. There are 7 road junctions with these towns. Blandford's system is concentrated along Rt. 23 and the town center. It does not extend in close proximity to town boundaries. The Springfield Regional System has its source of supply in Blandford but extensive work is required to make that source an emergency source for Blandford.

Regular Connections: None

Emergency Connections: None

Potential: Limited

Water Emergencies:

Blandford has no emergency supply source.

Future Needs:

Blandford needs to upgrade its transmission lines, develop a filtration system and develop an emergency supply.

BRIMFIELD

Sources of Supply

There is no public water supply system in Brimfield. The entire population is served by individual on-site wells. There are no known potential sources of public water supply available to Brimfield and no plans to develop a public water system.

Water Demand

Not available

Pricing Policy

The full cost of water is assumed by each user.

Protection Strategies

Water Supply Zoning: *Under Consideration*
Land Acquisition: *None*

The Brimfield Planning Board has urged the adoption of a cluster bylaw. By-law language is on the warrant for the 1990 Spring Town Meeting. In addition, the Conservation Commission is working on language for a Water Supply Protection Overlay District.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *None*

Leak Detection

Not Applicable

Intermunicipal Connections

Existing: *None*
Potential: *None*

Water Emergencies:

There is no strategy to deal with water emergencies.

Future Needs:

Brimfield is experiencing considerable growth and expects that its water needs will be much greater in the future. In addition, there is an increase in possible sources of contamination. Its future needs include additional supply, emergency plans and supply protection strategies.

CHESTER

Sources of Supply

The Chester Water Department supplies approximately 700 of the Town's estimated 1270 population (55%). The remainder of the population is served by on-site wells. Chester uses the following sources:

Type/Name	Location	Capacity	Safe Yield
Horn Pond	Off Bancroft Road Beckett	40 mg.	.12 mgd.
Austin Brook Storage Reservoir	Austin Brook Chester	1 mg.	.06 mgd. .18 mgd.

Water Demand

1988 Total Water Consumption: *37.6 mg*
1988 Safe Yield: *.18 mgd.*
1988 Average Day Demand: *.10 mgd.*
1988 Maximum Day Demand: *.19 mgd.*

The 1988 average daily demand was .10 mgd. The maximum day demand was .19 mgd. Currently, Chester has a small average surplus of .08 mgd. The maximum demand exceeds the safe yield and Chester can expect water shortfalls during extended periods of maximum demand. Chester has added very few services in the last 10 years. The surplus is expected to be .06 mgd. by the year 2000. Maximum day demand is projected to be above the safe yield by .03 mgd. by the year 2000

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	1,123	730	--	0.20	0.27	0.2
1988	1,270	737	140	0.10[1]	0.19	0.18
1995	1,316	763	140	0.11	0.20	0.18
2000	1,436	833	140	0.12	0.21	0.18
2010	1,696	984	140	0.14	0.25	0.18

1287 = Total population which could be served by 1988 safe yield

[1] The reduction in demand from 1980 to 1988 most likely reflects the loss of large industrial use.

Pricing Policy

Water Pricing Policy: *Unmetered Flat Rate*
Water Rate: *$42/6 month period*

Protection Strategies

Water Supply Zoning: *Not Adopted*
Land Acquisition Strategy: *Not Adopted*

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

Chester has not adopted specific zoning requirements to conserve water. The Town does not promote water conservation and has not replaced plumbing fixtures with water conserving devices in any municipal buildings.

Leak Detection

Leak detection: Not actively pursued

Chester has not developed a leak detection program.

Intermunicipal Connections

Chester has small distribution system centered around the Town Center. While it abuts 3 towns Blandford, Huntington and Worthington in 8 roadway locations, there are no possible interconnections.

Regular Connections: *None*

Emergency Connections: *None*

Potential Connections: *Limited*

Water Emergencies:

No water emergency strategy has been developed.

Future Needs:

Chester needs to replace the Horn Pond transmission line, plan for water infiltration and chlorination and correct inadequate transmission line capacity.

CHESTERFIELD

Sources of Supply

There is no public water supply system is Chesterfield. All of the population is served by individual on site wells. There are no known potential sources of public water supply available to Chesterfield and no plans to develop a public water system.

Water Demand

Not Available

Pricing Policy

The full cost of water is assumed by each individual user.

Protection Strategies

Water Supply Zoning: *Under development*
Land Acquisition Strategy: *Not Applicable*

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*
New State Plumbing Code Enforcement: *Actively enforced*

Leak Detection

Leak Detection Program: Not Applicable

Intermunicipal Connections

Existing: Not Applicable
Potential: None

Water Emergencies:

There is no strategy to deal with water emergencies.

Future Needs:

Chesterfield does not anticipate any significant change in the Town's water supply within the foreseeable future.

CHICOPEE

Sources of Supply

The Chicopee Water Department serves 99.9% of the City's population with water supplied primarily form the MWRA Quabbin Reservoir via the Chicopee Valley Aqueduct. Chicopee's contract with the MWRA runs out in the year 2000. The remaining .1% of the population, residing in a 48-unit apartment complex, is served by an individual on-site well. The City does not expect to issue further permits for private wells. Westover Air Force Base is metered as one user and purchases all of its water from the City.

Potential sources of supply include another connection to the Quabbin Reservoir to Chicopee paralleling the Chicopee Valley Aqueduct .

Water Demand

1988 Total Water Consumption:	*3,852 mg*
1988 Safe Yield:	*
1988 Average Day Demand:	*10.5 mgd.*
1988 Maximum Day Demand:	*17.3 mgd.*

* *There is no contractual upper limit to the amount of water Chicopee can draw from the Quabbin.*

Chicopee's present and future average day demand levels are below the mgd safe yield of the system. However, the City expects that it will not have enough water to meet peak summer demand by the year 2000 if additional supply cannot be established. Currently the City experiences water pressure problems in two high elevation areas due to inadequate transmission line capacity. The pressure has gotten down as low as seven or eight pounds in those areas.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	55,112	55,112	185	10.18	17.03	--
1988	57,408	57,350	185	10.59	17.36	
1995	57,408	57,305	185	10.59	17.36	
2000	60,522	60,461	185	11.17	18.30	
2010	65,029	64,964	185	12.00	19.67	

1 There is no contractual limit yet established by MWRA.

Pricing Policy

Water Pricing Policy: Declining Block Rate

Chicopee is in the process of changing its water pricing policy from a declining block rate to a uniform block rate. It is doing this by increasing its rates for water consumption above 1000 cubic feet. As of October 1,1989 it's water rate schedule was as follows:

Minimum charge for 1000 cubic feet or less per quarter/$7.50
Over 1000 cubic feet per quarter
First 150,000 cubic feet per quarter..... `$7.50/1000 cu. ft.
Next 850,000 cubic feet per quarter..... $3.33/1000 cu. ft.
Next 4,000,000 cubic feet per quarter..... $1.50/1000 cu. ft.

These rates reflect the two increases that were voted in 1989. The last rate increase prior to these was in 1982. Additional increases in the lowest two rates are expected in 1990 and 1991.

Protection Strategies

Water Supply Zoning: *Under consideration*
Land Acquisition Strategy: *Not Adopted*

The drought contingency plan prepared by the Chicopee Water Department has recommended that the City adopt protective zoning strategies.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Under consideration*
New State Plumbing Code Enforcement: *Actively enforced*

Chicopee has developed a public education brochure on water conservation that is included with every water bill, and the new State Plumbing Code regulations requiring low-flow shower heads and water conserving toilets are actively enforced in all new buildings.

In addition, the City has prepared a lengthy report detailing conservation and water supply protection strategies. Recommended actions, many of which have already been taken, are as follows:

1. 100% metering of all consumptive users, including public buildings
2. On-going metering program with the ability to test, recalibrate, repair or replace meters on a regular basis
3. Check 100% of the system for leaks every other year (at least every 5 years)
4. Fix every detectable leak as soon as possible
5. Have an on-going system rehabilitation program with adequate financial resources for maintenance and unexpected problems
6. Collect revenues to cover the full cost of providing water
7. Set up an enterprise fund account for water
8. Use an increasing block rate structure
9. Institute seasonal pricing to reduce peak demands
10. Do frequent billing and stagger the billing procedure
11. Develop an on-going education program which includes bill stuffers, school curriculum, education program for municipal employees
12. Adopt an emergency response plan outlining specific responsibilities

13. Adopt a progressively stringent reduction program indicating who will reduce where, how much and how
14. Actively enforce the building and plumbing code for new construction and substantial rehabilitation
15. Retrofit public buildings with water saving devices
16. Retrofit residential and non-residential buildings with water saving devices
17. Identify critical water resource areas
18. Acquire land or development rights to these areas
19. Adopt zoning to protect these areas
20. Adopt by-laws for control of underground storage tanks, hazardous materials, road salt erosion
21. Inventory land uses in critical water resource areas
22. Establish a water resources protection committee
23. Begin an education program to increase awareness of the relationship between land use and water quality impacts

Leak Detection

Leak Detection: *Actively Pursued*

Chicopee has actively sought to determine the extent and location of leaks in its 134.42 miles of water mains. Last year MWRA assisted the City in this effort and it was discovered that 19.5% of the water was unaccounted for. At this point both the City and MWRA expected to find a serious leakage problem. However, a thorough investigation showed the problem was not one of leaks, but of faulty meters.

Intermunicipal Connections

Chicopee receives it's water from the Quabbin reservoir via the Chicopee Valley Aqueduct to the Nash Hill Reservoir in Ludlow. Water is then moved via a 36" pipeline from the Nash Hill Reservoir to Chicopee. Chicopee abuts the following municipalities which have central supply systems: South Hadley, Ludlow, Springfield, West Springfield, Holyoke.

Chicopee maintains regular connections with the MWRA via the Chicopee Valley Aqueduct. Emergency connections are maintained with South Hadley at New Ludlow Road and Springfield at East Street and Center Street and North Main Street.

Potential connections are currently being assessed by Tighe and Bond Engineering as part of the MWRA study to determine the feasibility of supplemental supply sources. Potential road junction sites with Springfield include Newbury Street, Springfield St., Broadway - Liberty St., and St.. James Ave. Springfield's lines at Newbury and St. James Avenue are 16" lines to smaller lines in Chicopee. The Springfield Street and Broadway -Liberty Street sites have 8" lines in Springfield. Lines need to be extended along Liberty Street.

A potential connection has been proposed with Holyoke along the Willimansett Bridge. A potential connection exists with South Hadley at Montcalm Street between South Hadley Fire District #1 8" line and Chicopee's line.

Regular Connections:
Permanent long term: MWRA

Emergency Connections:

Temporary short term:	South Hadley Fire District #1 - New Ludlow Road Springfield - East Street - Center Street
Potential Connections:	Springfield - Newbury Street - St. James Avenue Holyoke - Willimansett Bridge South Hadley Fire District #1 - Montcalm Street

Water Emergencies:

Chicopee maintains emergency connections with South Hadley and Springfield. It does not have backup or redundant supplies of its own that can be activated in times of emergency.

Future Needs:

In addition to increased supply of water, Chicopee's future needs include the replacement of old mains at Westover Air Force Base, a water treatment plant for corrosion control and possible filtration, and increased capacity of its transmission lines.

CUMMINGTON

Sources of Supply

Cummington is served by two separate supply systems which are both owned and operated by the Town of Cummington. The Cummington Water Department serves 42% of the population who live in Cummington Center. The West Cummington Water Department serves 17% of the Town's population who live in the Village of West Cummington. The remaining 41% of the population is served by individual on-site wells. The Cummington Water Department uses the following water sources:

Type/Name	Location	Capacity	Safe Yield
Ballfield well (gravel packed)	Off Main St in Cummington Center near town ballfield	-	not available

Cummington recently spent $1.2 million to upgrade the Cummington Water Department system. A new well was installed, new pump installed, and over 11,000 ft of line installed. There are two storage tanks (100,000g & 86,000g). This overhaul has taken 2 years and is expected to be complete in early 1990. The Cummington Center well (off Main St. near Plainfield St.) which had been the main source of supply, (safe yield .015 mgd) will be used as a backup supply. The Cummington Water Department has a spring fed wellfield located on Potash Hill in Cummington Center consisting of two wells which are only used as an emergency back-up supply.

The West Cummington Water Department uses the following water source:

Type/Name	Location	Capacity	Safe Yield
West Cummington Well (2 gravel packed wells)	Off River Rd. West Cummington	-	.043 mgd.

Water Demand - Cummington Water Department

1986 Total Water Consumption: *3.9 mg.*
1986 Safe Yield: *(not available at this time)*
1986 Average Day Demand: *.01 mgd.*

Water Demand - West Cummington Water Department

1986 Total Water Consumption: *1.8 mg.*
1986 Safe Yield: *.045 mgd*
1986 Average Day Demand: *.004 mgd.*

Data for Cummington's safe yield and 1988 demand was unavailable. The new ballfield well should adequately supply Cummington Center well into the future.

Supply and Demand Summary and Projections
Cummington Center

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	657	276	36	0.01	0.01	0.015
1988	800	336	32	0.01	0.01	
1995	990	416	32	0.01	0.01	
2000	915	384	32	0.01	0.01	
2010	1,130	474	32	0.02	0.01	

Supply and Demand Summary and Projections
West Cummington

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	657	112	36	0.004	0.004	0.043
1988	800	136	36	0.005	0.005	0.043
1995	990	168	36	0.006	0.006	0.043
2000	915	156	36	0.006	0.006	0.043
2010	1,130	192	36	0.007	0.007	0.043

1186 = Total population which could be served by 1988 safe yield

Water Pricing Policy

Water Pricing Policy: *Unmetered flat rate/metered*
Water Rate: *$105/2000 cu ft per 6 month period*
$16.00/1000 cu. ft.

Cummington charges a combined flat rate and metered rate. The first 2000 cu. ft. consumed in a 6 month period costs $105. Any additional use is charged at $16.00/1000 cu. ft. These rates reflect the full cost of water delivery. An enterprise account has been established.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Actively pursued.*

Cummington has adopted a water supply protection zoning bylaw, an underground storage tank bylaw, and a hazardous materials bylaw. The Town is seeking to purchase land owned around its new wellfield. A road salt policy statement to control salt application along sensitive portions of Rt. 9 has improved a previous sodium problem to where now sodium levels pass D.E.P standards.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*
New State Plumbing Code Enforcement: *Not actively enforced.*

Cummington has not adopted specific zoning regulations to conserve water. The new state plumbing code is not actively enforced and water conservation devices have not been installed in municipal buildings. The Town does not actively encourage water conservation practices.

Leak Detection

Leak detection: *Actively pursued*

Cummington owns leak detection equipment and is seeking to upgrade that equipment.

Intermunicipal Connections

The two systems are small distribution systems located around the two village centers and Rt 9. There is over a 6 mile distance between the Cummington and West Cummington System making an interconnection difficult. In addition, the Town of Cummington abuts 7 towns but only 1, Worthington has a small central system.

Regular Connections: *None*

Emergency Connections: *None*

Potential Connections: *None*

Water Emergencies:

There are emergency back-up sources of supply from the Main St. well and Potash Hill wellfield for the Cummington Center Water Department. West Cummington does not have an emergency supply.

Future Needs:

Cummington need to finalize acquisition of land surrounding the ballfield well. The distribution system in West Cummington needs to be improved.

EAST LONGMEADOW

Sources of Supply

The East Longmeadow Department of Public Works purchases water from the Springfield Regional Water System to supply 99% of the Town's population. The remaining 1% of the population is served by private wells.

Water Demand

1988 Total Water Consumption: *639.5 mg.*
1988 Safe Yield: *Not applicable*
1988 Average Day Demand . *1.78 mgd.*
1988 Maximum Day Demand:

In 1988 East Longmeadow purchased 649,791,508 gallons of water from the Springfield Regional Water System Of that amount, 10,340,352 gallons were sold to the Connecticut Water Company. It is expected that the high rate of development in East Longmeadow will lead to increased demand, but that the Springfield Water System will be able to meet the increased needs of East Longmeadow.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	12,905	12,518	100	1.25	2.50	--[3]
1988	13,636	13,500	130	1.75	3.50[2]	
1995	14,276[1]	14,133	130	1.83	3.66	
2000	16,485	16,320	130	2.12	4.23	
2010	19,469	19,274	130	2.50	5.00	

1 The 1995 population projection is based on the straight line method only.
2 The 1988 MDD data was unavailable. The number here is an estimation based on the 1980 MDD/ADD ratio.
3 No contractual upper limit has been established yet by the Springfield Regional System.

Water Pricing Policy

Water Pricing Policy: Declining Block Rate
Water Rate: *First 20,000 cubic feet : $13.00/1,000 cu. ft.*
Next 40,000 cubic feet : $12.00/1,000 cu. ft.
Over 60,000 cubic feet: $11.00/1,000 cu. ft.

Residents and business in East Longmeadow are charged for their water using a declining block rate system. As of July 1, 1989 the water rates were increased.

Protection Strategies

Water Supply Zoning: *Not applicable*
Land Acquisition Strategy: *Not applicable*

No protection zoning strategies have been undertaken to protect the East Longmeadow water supply because it is purchased from Springfield.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: None

No water conservation programs have been adopted in East Longmeadow and none are being contemplated.

Leak Detection

Leak Detection : *Not actively pursued*

Intermunicipal Connections

East Longmeadow has over 92 miles of main 8" or over. The Town abuts 3 municipalities with central supply systems. There are numerous road junctions with Springfield and Longmeadow with major arteries and minor residential streets. East Longmeadow relies on the Springfield Regional Water System for its main supply. It maintains 4 regular permanent connections which meets the town's regular and emergency needs. The Harkness Avenue connection has recently been upgraded to a 24 inch line.

In addition, the Connecticut Water Company maintains a connection to the East Longmeadow system at the town line on Shaker Road in order to facilitate the purchase of water from East Longmeadow. In 1988 CWC purchased 10,340,352 gallons. The water is used to serve customers in the Town of Enfield, Connecticut. It is the CWC's expectation that they will continue to purchase like amounts of water from East Longmeadow in the foreseeable future.

Regular Connections:

Permanent long term:	Springfield	- Harkness
		- North Main Street
		- Elm Street
	Longmeadow (Spfld. system)	- Chestnut Street
	Enfield, Conn	- Shaker Road

Emergency Connections: None

Potential Connections: Limited

Water Emergencies:

East Longmeadow is completely dependent on the Springfield Water System for its supply. The Springfield system has excess capacity in the form of additional unused reservoirs that can be brought on line during a period of water emergency.

Future Needs:

Because of rapid growth in the town's population, increased capacity to transmit water from Springfield is the primary need of the community.

EASTHAMPTON

Sources of Supply

Easthampton has a public water supply system which serves almost 100% of its estimated 15,580 population. It is operated by the Easthampton Department of Public Works, Water Division . Easthampton also serves one shopping complex in Southampton for fire protection. The following sources are used:

Type/Name	Location	Capacity	Safe Yield
Hendrick St. Wellfield (106 2.5" and one 8" wells) (wells #3 and #4)	Hendrick St	-	(see below)
Pines Well 10" gravel packed #5	Hendrick St		4.5 mgd (combined)
Nonotuck Park Well #6	Nonotuck Park	-	1.5 mgd
Lovefield St. Well #7 18" gravel packed	Lovefield St.		1.5 mgd 7.5

The 7.5 mgd total safe yield of the system is limited to 6.5 mgd by the distribution system hydraulics. The Town also maintains two concrete storage tanks. One 1.68 mg tank is located in the eastern section of Town on the westerly slope of the Mt. Tom Range. The second 4 mg reservoir was constructed in 1989 off of Dury Lane. The function of the reservoirs are to provide uniform water pressure, to maintain service during power or pump failure, and to provide for fire protection. New studies are currently underway to determine the accuracy of safe yield amounts for the Hendrick St. Well sites. The safe yield may be reduced from 4.5 mgd to 3.5 mgd. The Hendrick St. wells have suffered from TCE contamination.

Water Demand

1988 Total Water Consumption:	*963.63 mg.*
1988 Safe Yield:	*6.5 mgd..*
1988 Average Day Demand:	*2.6 mgd.*
1988 Maximum Day Demand:	*4.9 mgd.*

Easthampton currently has a surplus of 1.6 mgd.. The surplus is expected to be .6 mgd. by the year 2000. The limited distribution system capacity has lowered water pressure in high elevation areas on high demand days and may cause water deficits in the future. The currently uncertain status of the contaminated Hendrick St. wells will determine if Easthampton has a surplus in the future.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	15,580	15,424	206	3.18	4.80	6.5
1988	16,160	16,160	163	2.64	4.90	6.5
1995[1]	16,668	16,668	185[2]	3.08	5.71	6.5
2000	17,130	17,130	185	3.16	5.87	6.5
2010	18,421	18,421	185	3.40	6.31	6.5

35,218 = Total population which could be served by 1988 safe yield

1 1995 population projection is based only on a straight line projection.
2 Demand projections based on an average of 1980 and 198 gped.

Water Pricing Policy

Water Pricing Policy: *Uniform Block rate*
Water Rate: *$6.50/1000 cu ft.*

Easthampton has a uniform block rate of $6.50/ 1000 cu. ft. Price increases have already been approved which will incrementally raise the rate to $10.00 in 1992. The full cost of water is currently recovered. An enterprise account has been established. 4,720 of the 4,937 services, 95%, are currently metered.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Adopted*

Easthampton has adopted a zoning overlay district to protect groundwater supplies in the southern section of town. Fifty acres are owned by the town surrounding the Nonotuck Park well field, 4 acres surrounding the Lovefield wellfield, and 25 acres surrounding the Hendrick St wellfield. The Hendrick St. wellfield is located adjacent to a highway in a somewhat residential area. Easthampton has participated in a recent Aquifer land acquisition study. A reduction in salt use and a change in the sand/ salt mixture have reduced the threat of sodium contamination. Easthampton, along with Southampton, Holyoke, Westfield, and PVPC, has approved a Memorandum of Agreement for cooperative protection of the Barnes Aquifer, the main water source for these municipalities. This agreement establishes a committee to provide for intermunicipal review of all major development projects within the aquifer area, to coordinate uniform development of land use controls, and to be a forum for future educational or governmental action.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*
New State Plumbing Code Enforcement: *Actively enforced*

Easthampton has not adopted specific zoning regulations to conserve water. The new State Plumbing code is actively enforced in all new construction but plumbing fixtures have not been replaced in any municipal buildings. Easthampton offers water loss information at the Public Works office but does not promote an active water conservation education program.

Leak Detection

Leak detection Program: Not actively pursued

Easthampton has not pursued a leak detection program and is interested in sharing leak detection equipment with other towns. 163.82 mg, 17%, of Easthampton's 1988 water consumption is reported unaccounted for.

Intermunicipal Connections

Easthampton has an extensive distribution system with over 44 miles of main over 8" in diameter. Easthampton abuts 3 other municipalities with central supply systems: Southampton, Northampton and Holyoke at 21 road junction sites. Both Northampton and Holyoke have surplus supplies. Easthampton maintains a regular connection with Southampton along Main Street (Rt. 10) to provide service to a shopping development.

Easthampton maintains an existing emergency connection with Northampton along Northampton Street. An intermunicipal agreement exists between the two municipalities. There are potential road connection sites with Northampton at 9 locations: Loudville Road, Drury Lane, Torrey St. - Glendale Rd., Oliver St., Park Hill Road, Florence Road, Lovefield St., Clapp Street, Old Springfield Road, and Route 5. Six of the sites have no line from Northampton: Loudville Road, Drury Lane, Oliver Street, Park Hill Road, Lovefield Street, Clapp Street-Old Springfield Road. The Torrey Street-Glendale Road connection experiences low pressure. In addition , a line would need to be extended from Easthampton approximately 750'. There is a pipe size differential and relatively small line in Easthampton at that site. The Florence Road site offers good potential for a connection. Lines extend to the boundaries in both municipalities, line sizes are similar. A pressure differential exists which would have to be corrected. Another site with limited potential for a connection is along Route 5. Both lines are greater than 8" and pressure is good in Northampton. Lines would need to be extended however from both municipalities.

There are potential road connection sites with Southampton at 8 locations: However, Southampton's small system is concentrated along Route 10 and the town center. It does not extend to the town extremities. The only potential emergency interconnection is along Route 10.

Easthampton has 3 road conjunctions with Holyoke at Mountain Road - Easthampton Road, Route 5 and Reservation Road. The Mountain Road site has a geographic limitation of a steep slope and low pressure coming from Holyoke. Reservation Road is state property and does not have a line. The Route 5 site offers limited potential for an interconnection. The Easthampton 8" line extends to the town boundary. The Holyoke line would need to be extended.

Regular Connections:	
Existing Service Agreement:	Southampton - Route 10
Emergency Connections:	
Temporary Short term:	Northampton - Northampton Street
Potential Connections:	Northampton - Torrey St.
	Southampton - Route 10

Water Emergencies:

Easthampton does not have a backup supply. In an emergency Easthampton can connect with the Northampton system. An intermunicipal emergency agreement exists between the two towns.

Future Needs:

Easthampton faces the possibility of building water treatment facilities to clean up TCE contamination in two of its four wellfields. A study is currently underway. Transmission lines will need to be upgraded to correct supply distribution inadequacies. Sodium levels will continue to be monitored carefully to protect against sodium contamination.

GOSHEN

Sources of Supply

There is no public water supply system in Goshen. The population is served by on-site wells. There are no known potential sources of public water supply available to Goshen and no plans to develop a public water system.

Water Demand

Not available

Pricing Policy

The full cost of water is assumed by each user.

Protection Strategies

Water Supply Zoning: None
Land Acquisition: None

Goshen has adopted a policy of low road-salt use in order to protect individual wells along main street.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: None

Leak Detection

Not Applicable

Intermunicipal Connections

Existing: None
Potential: None

Water Emergencies:

There is no strategy to deal with water emergencies.

Future Needs:

Goshen does not anticipate any significant change in its water supply needs within the foreseeable future.

GRANBY

Sources of Supply

There are no public water supplies located in Granby. A small portion of the population (10%) receives its water from South Hadley Fire District 2 along Route 116 and from four non-community public water supplies, which supply their own facilities.

Water Demand

Unavailable

Pricing Policy

Water Pricing Policy: *Uniform Block Rate*
Water Rate: *$8.50/1000 cu. ft.*

The full cost of water is assumed individually by each individual user. For those residents on the South Hadley system, the rate is $8.50/1000 cu. ft. through a uniform block rate.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Not Applcable*

Granby has adopted a water supply protection bylaw. In addition, a low salt policy has been adopted for selected segments of Rt. 202

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

Leak Detection

Leak detection: *Not Applicable*

Intermunicipal Connections

Granby does not maintain it's own central water supply system. The Chicopee Valley Aqueduct line from the Nash Hill Reservoir in Ludlow is located along Ludlow Road. A small number of residents receive water from South Hadley Fire District #1 through this connection. A small number of residents receives water from South Hadley Fire District #2 along Route 116 in the northwest section of town. The lines there are 6" reducing to 4" and extend to Oak Drive. There are no emergency or potential connections.

Existing Connections:
Service Arrangement: South Hadley Fire District #2 off Rt. 116
South Hadley Fire District #1 off Ludlow Road

Emergency Connections: None

Potential Connections: Limited

Water Emergencies:

There is no strategy to deal with water emergencies

Future Needs:

Granby needs to insure that groundwater supplies are adequately protected.

GRANVILLE

Sources of Supply

There is no public water supply system in Granville. Most residents are served by individual, on-site wells. Thirty-four households are served by the privately owned Granville Center Water Company. The Water Company gets its supply from four springs that feed a reservoir off Regan Road and an artesian well near Blandford Road.

Type/Name	Location	Capacity	Safe Yield
Springs (4) & Storage Reservoir	Off Regan Road	6,200	combined
Drilled Artesian Well	Off Blandford Road		.02 mgd

Water Demand

1988 Total Water Consumption:
1988 Safe Yield: *.02 mgd.*
1988 Average Day Demand:
1988 Maximum Day Demand:

Pricing Policy

Those who are served by individual wells assume the full cost of water. Residents served by the Granville Center Water Company are charged $100 per year and $.75 per 1000 gallons over 1000 cubic feet.

Protection Strategies

Granville does not have any water or well protection zoning in place. The Granville Center Water Company owns one acre around its well and thirty-five acres of watershed land for its reservoir. During the summer of 1989 The Granville Center Water Company had to discontinue use of three of the springs that feed its reservoir due to high coliform counts. Spring water has been tested weekly since that time and no coliform count has been registered since September 1989. The Company is hoping it will be able to begin using the springs again and is working with the Department of Environmental Protection to develop engineering strategies to protect the from future pollution.

Conservation Programs/Regulations

The Town does not have any water conservation programs in place.

Intermunicipal Connections

The Granville Center Water Company has a very limited distribution system. The town abuts Southwick, Westfield, Russell and Blandford which have central supply systems. The main distribution line from Westfield's Granville Reservoir is located in the Northeast section of the town. The limited nature of Granville's systems precludes any interconnections.

Regular Connections: None

Emergency Connections: None

Potential Connections: Limited

Water Emergencies:

There is no strategy to deal with water emergencies.

HADLEY

Sources of Supply

The Hadley public water supply system, owned and operated by the Hadley Water Department, serves 100% of the Town's population except for a few commercial connections along Route 9 which are served by the Amherst system. The Hadley Water Department uses the following sources:

Type/Name	Location	Capacity	Safe Yield
Mt. Warner Road Wellfield (2 gravel developed wells)	Mt. Warner Rd., N. Hadley	--	1.9 mgd.
Callahan Wellfield (2 gravel developed wells)	Bay Rd. (at Fort River)	--	2.6 mgd. 4.5 mgd.

Three municipal reservoirs, Parker reservoir and Upper and Lower Harts Brook Reservoirs were all abandoned due to small capacity and treatment needs. Additional wells can be developed in the Bay Road wellfield and potential groundwater resources exist in the Hockanum area of town. This potential source has an estimated potential yield of 1 mgd, but is of poor quality and would require extensive treatment.

Water Demand

1988 Total Water Consumption:	*276.4 mg .*
1988 Safe Yield:	*4.5 mgd.*
1988 Average Day Demand:	*.8 mgd.*
1988 A Maximum Day Demand:	*2.3 mgd.*

Total water consumption in Hadley for 1988 was 276.4 mgd. Hadley has a surplus water supply to meet both its present and future needs. The present surplus is 2.2 mgd. and the surplus is projected to be 1.98 mgd. in the year 2000.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	4,125	4125	191	0.79	1.77	4.5
1988	4,300	4300	176	0.76	2.30	4.5
1995	4,532	4532	183	0.83	2.52	4.5
2000	4,630	4630	183	0.85	2.58	4.5
2010	5,050	5050	183[1]	0.93	2.81	4.5

24,533 = Total population which could be served by 1988 safe yield

1 Demand projection based on an average of 1980 and 1988 gpcd.

Pricing Policy

Water Pricing Policy: *Unmetered flat rate/Uniform block rate*
Water Rate: *Based on number and type of fixture/$7.50/1000 cu ft*

Hadley has both an unmetered flat rate and a uniform block rate. The metered rate is $7.50/1000 cu ft. Metering is mandatory for commercial and industrial use but optional for residential use. The flat rate is as follows: (Flat rate bills are billed twice per year)

$27.50 per family; $25.00 per family if there is more than one;
$11.25 for the first bath per family; $5.00 for each additional bath;
$11.25 for the first water closet per family; $5.00 for each additional
$8.75 for each outside faucet; $6.25 for a swimming pool
Animals and crops are billed separately
Cows/horses - $.63 each per billing period
Sheep/Swine - $.31 each per billing period

Crops (tobacco, potatoes) are billed once a year in October at the rate of $1.06 per acre

This price policy represents less than the full cost of water delivery and the Town has plans to increase the rate. At the end of 1988, approximately 530 of the 1630 services were metered (33%). All new construction and all commercial and industrial users are metered. The spring 1989 Town Meeting defeated a provision to adopt town wide metering. However, the Town plans to adopt universal metering in the future.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Adopted*

Hadley has adopted an aquifer overlay zoning regulation as well as an acquisition strategy to protect the Mt. Warner wellfield. The town received a D.E.P. Aquifer Lands Acquisition grant of $360,000 to protect its supply. Some land around the Mt. Warner wellfield currently is protected by conservation restrictions. A sewer system was recently installed in the Mt. Warner area and waste water treatment facilities have been recently expanded.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*
New State Plumbing Code Enforcement: *Enforced*

Hadley has not adopted specific zoning regulations to conserve water. The Town encourages the use of water saving devises in the home but has not yet established either an educational program or a program to distribute or install water saving devices. The Town enforces the new state plumbing code regulations and has replaced plumbing fixtures in some municipal buildings.

Leak Detection

Leak Detection Program: *Not actively pursued*

The Town is in the process of establishing a leak detection program. Any future water price increase may be specifically targeted for a leak detection program.

Water Emergency:

With treatment, the town could re-activate use of the reservoirs in an extreme emergency. The Bay Road wells are only occasionally used in times of extreme demand. The presence of manganese in the Bay Road wells causes discoloration problems.

Intermunicipal Connections:

Hadley has over 75 miles of mains. The distribution system extends extensively throughout the town. Hadley abuts 5 municipalities with central water supply systems; Hatfield, Northampton, South Hadley, Amherst and Sunderland. The Connecticut River limits potential connections with Hatfield and Northampton. The Holyoke Mountain Range would make an interconnection with South Hadley expensive. There are 12 possible road way junctions with the other municipalities. There are no major supply lines in town.

Hadley has one regular connection with Amherst. A small number of commercial establishments along Route 9 receive water from Amherst. Hadley has one emergency connection with Amherst along Roosevelt Street. This connection was used in the early 1980's to supplement Amherst's water supply. No formal agreement exists with Amherst.

There are potential road connection sites with: Amherst at Bay Road - West Bay Road, Mill Valley Road - Hadley Road, Route 9, Comins Road - Russellville Road; Sunderland at Route 47; and South Hadley at Route 47.

The sites with the most potential are: the Sunderland-Route 47 site where Hadley's 8" line and Sunderland's 12" line extend to the boundary; the Amherst Route 9 site where Hadley's 8" line is within close proximity to Amherst 8" line; the Amherst Bay Road - West Bay Road site. This site requires a line extension by Hadley.

The Russellville Road - Comins Road site with Amherst also offers potential as both lines extend to town boundaries. However the existing emergency connection is "down" line from this site along Amherst's distribution system potentially limiting the volume able to be received. The South Hadley Route 47 site is constrained by the steep slope of the topography and would require a line extension by South Hadley.

Regular Connections:

Existing Service Agreements:	Amherst -	Route 9

Emergency Connections:

Temporary short term :	Amherst-	Roosevelt Street

Potential Connections:

Sunderland-	Route 47
Amherst -	Route 9
	Bay Road

Future Needs:

Hadley needs to continue to pursue a leak detection program, replace old lines along West St., and develop a filtration system for the manganese in the Bay Road wells.

HAMPDEN

Sources of Supply

There is no public water supply system in Hampden. Almost the entire population is served by individual on-site wells. The remaining 1% of the population is served by the Centennial Commons private well which has a safe yield of .762 mgd. The only known potential source of public water supply available to Hampden is the Scantic River.

Water Demand

Not available

Water Pricing Policy

The full cost of water is assumed by each user.

Protection Strategies

Water Supply Zoning: None
Land Acquisition: None

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: None

Leak Detection

Not Applicable

Intermunicipal Connections

Existing: None
Potential: None

Water Emergencies

There is no strategy to deal with water emergencies.

Future Needs

Hampden does not anticipate any significant change in its water supply needs within the foreseeable future.

HATFIELD

Sources of Supply

The Hatfield public water system, owned and operated by the Hatfield Water Department, serves approximately 3000 residents, about 95% of the towns population. The remaining 5% is served by individual on-site wells. The Hatfield Water Department uses the following sources.

Type/Name	Location	Capacity	Safe Yield
Running Gutter Reservoir	Linseed Road	n.a.	.25mgd
Well #1 (gravel packed)	Running Gutter Brook Linseed Rd (south of reservoir)	-	.3 mgd.
Omasta Well	Off Mountain Rd by Rte. 91 in N. Hatfield	-	.2 mgd. .75 mgd.

The main source of supply is the reservoir. The two wells are mainly used as emergency sources.

A new 500 gallon storage tank was installed in 1987, primarily to insure adequate pressure for the Brockway-Smith industrial development.

The Omasta well experiences supply problems. Fine sand particulates have clogged the screen which has decreased the safe yield from .4 mgd to .3 mgd. This well can only be pumped 1.5 hours on and 1 hour off.

Water Demand

1988 Total Water Consumption: *116.3 mg.*
1988 Safe Yield: . *75 mgd.*
1988 Average Day Demand: *.32 mgd.*
1988 Maximum Day Demand: *.75 mgd.*

Hatfield currently has a surplus of .43 mgd. However the maximum daily demand for 1988 was .75 mgd.. With continued heavy daily demand Hatfield may experience water shortages. Maximum day demand is projected to exceed the safe yield by .12 mgd. by the year 2000.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	3,045	2,436	115	0.28	0.40	0.41
1988	3,157	2,999	106	0.32	0.75	0.75
1995	3,369	3,201	111[1]	0.35	0.83	0.75
2000	3,500	3,325	111	0.37	0.87	0.75
2010	3,879	3,685	111	0.41	0.96	0.75

6,782 = Total population which could be served by 1988 safe yield

[1] Demand projections are based on an average of 1980 - 1988 gpcd.

Pricing Policy

Water Pricing Policy: *Unmetered flat rate/Uniform block rate*
Water Rate: *$120/yr. / $9.50/1000 cu. ft.*

Hatfield has two types of pricing policy. There is an unmetered flat rate of $120/yr. for those residents who have not installed meters. Metering is optional. The metered price is $9.50 for 1000 cu. ft. Less than 1% of the residences have installed meters. All of the industrials users and 20% of the commercial users have installed meters. Hatfield's water rates reflect the full cost of water and an enterprise account has been established. Hatfield plans to go to a full metering policy.

Protection Strategies

Water Supply Zoning: *In the process of being adopted*
Land Acquisition Strategy: *Adopted*

Hatfield is currently working with the Pioneer Valley Planning Commission to adopt a water supply protection strategy. Currently there is only large lot zoning to protect the reservoir's watershed. Approximately 208 acres around the reservoir is owned by Hatfield. The Town recently approved the acquisition of an additional parcel in the watershed. Hatfield owns 8 acres around the Omasta well and a 400 ft. radius around well #1.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*
New State Plumbing Code Enforcement: *Not actively enforced*

Hatfield has not adopted specific zoning regulations to conserve water. The new state plumbing codes are not actively enforced. Hatfield does not actively encourage water conservation through education. Water conserving plumbing devices have not been replaced in any municipal buildings.

Leak Detection

Leak Detection Program: *Not actively pursued*

Hatfield does not have a leak detection program. The Town is interested in sharing leak detection equipment with neighboring towns.

Intermunicipal Connections

Hatfield has approximately 30 miles of mains 8" or greater. It abuts 4 other towns with central water supply systems; Whately, Williamsburg, Northampton and Hadley. There are 10 road junctions with these towns. There are no regular connections in Hatfield. Hatfield has 4 emergency connections. These emergency connections were used in May of 1990 when a water line break in a remote area of town reduced supply to consumers. Hatfield was able to receive water from Northampton at the Route 5 and 10 site. Water lines are located on opposite sides of the highway at that site. This presents a problem for interconnecting. Hatfield also received water from Whately during this emergency. There are 3 locations for emergency connections between Whately. In this instance Whately received water from South Deerfield through an interconnection to supplement it's supply. Hatfield has only verbal agreements with both municipalities.

The potential for further emergency connections is limited. The Connecticut River separates Hatfield from Hadley. There are no water lines in the wooded, hilly area where Hatfield abuts Williamsburg and no other feasible roadway junctions with Northampton.

Regular Connections: None

Emergency Connections:

Temporary short term:
Northampton - West Street (Route 5)
Whately - West Street (Route 5)
- Straits Road
- River Road

Potential Connections: Limited

Water Emergencies:

In a water emergency Hatfield could readily connect with the Whately system.

Future Needs:

Hatfield needs to replace 4000' of 4" and 8" mains over the next year. The town is in the process of doing a one year weekly test for the need of a treatment plant. The policy of moving towards full metering needs to be continued. Specific aquifer protection zoning techniques needs to be adopted. More land, or more stringent protection needs to be in place around well #1. The potential water shortfall needs to be addressed.

HOLLAND

Sources of Supply

There is no public water supply system in Holland. The entire population is served by individual on-site wells. There are no known potential sources of public water supply available to Holland and no plans to develop a public water system.

Water Demand

Not available

Water Pricing Policy

The full cost of water is assumed by each user.

Protection Strategies

Water Supply Zoning: Under Consideration
Land Acquisition: None

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: None

Leak Detection

Not Applicable

Intermunicipal Connections

Existing: None
Potential: None

Water Emergencies:

There is no strategy to deal with water emergencies.

Future Needs:

Holland does not anticipate any significant change in its water supply needs within the foreseeable future.

HOLYOKE

Sources of Supply

The Holyoke Water Works serves almost 100% of the estimated 42,000 population. Less than 1% of the population are served by on-site individual wells. The following water sources are used by the Holyoke Water Works.

Type/Name	Location	Capacity	Safe Yield
Tighe-Carmody reservoir (also called Manhan)	Off Manhan Rd Southampton	4,850mg	13 mgd
Ashley Pond Reservoir	Off Westfield Rd. SW Holyoke	795mg	2.1mgd
McLean Reservoir	Off Rte. 202 SW Holyoke	370mg	.5mgd
Whitney St. Reservoir	Off Rte. 141, N. Holyoke	479 mg.	1.6mgd
		6,494mg	17.2 mgd.

In addition a fifth reservoir, White Reservoir, (safe yield unknown) just north of the Tighe-Carmody Reservoir (safe yield unknown) has been taken off line because of insufficient spillway capacity.

The West Holyoke wellfield (safe yield .17 mgd.) (off Rte. 202 in Southwest Holyoke) has been taken off line and the connections capped. The Pequot water supply wells, which previously served a small percentage of the population have also recently been capped and their use discontinued. These wells suffered from contamination. Currently there are two 20" transmission lines from the Tighe-Carmody Reservoir. These lines limit the full utilization of this supply. Only 6 mgd. of the 13 mgd can currently be transferred. A $10 million capital improvement project is proposed to replace these 2 20" lines with one 42" line, as well as improve other aspects of the distribution system.

Holyoke also supplied 42.7mg (.12mgd) to Southampton in 1988. Up to 650,000 gpd. is to be supplied to Southampton as a result of an agreement when the Tighe-Carmody Reservoir was constructed.

Water Demand

1988 Total Water Consumption:	*3,436.3 mg.*
1988 Safe Yield:	*17.2 mgd.*
1988 Average Day Demand:	*10.2 mgd.*
1988 Maximum Day Demand:	*13.6 mgd.*

Holyoke has a surplus of 7 mgd. Even with the reduced safe yield resulting from the inadequate Tighe-Carmody transmission lines Holyoke has surplus. Water consumption has declined in Holyoke in recent years, due to a loss of industrial users. Holyoke is expected to have a surplus of 7 mgd. in the year 2000. As a result of this anticipated surplus Holyoke wants to sell water, possibly to those neighboring communities, Chicopee and South Hadley, now served by the MDC.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	44,678	43,784	283	12.39	12.94	15.28
1988	42,000	42,000	224	9.41	13.60	17.20
1995	40,127	40,127	254	10.18[2]	14.70	17.20
2000	40,295	40,295	254	10.22	14.76	17.20
2010	40,631[1]	40,631	254	10.30	14.88	17.20

67,827 = Total population which could be served by 1988 safe yield

[1] 2010 population projection based on straight line increase from 1995 - 2000.
[2] Projections based on an average of 1980 and 1988 ADD.

Pricing Policy

Water Pricing Policy: *Declining Block Rate*
Water Rate: *Minimum quarterly charge is $21.00*

0-500,000 gal.	$10.47/1000 cu ft
500,001-1,000,000 gal.	$9.72/1000 cu ft
1,000,000-5,000,000 gal.	$8.97/1000 cu ft
over 5,000,000 gal.	$8.23/1000 cu ft

Holyoke currently charges a declining block rate based on the volumes listed above. The water rates reflect the full cost of water delivery. An enterprise account has been established. Water and sewer services are billed together Sewer rates are $1.36/1000 cu ft. 8,030 of the 8,052 services are metered. Plans are in place to change the water pricing policy to a uniform block rate. The change is proposed to be phased in over several years to coincide with the capital improvement expenditures.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Adopted*

Holyoke has water supply zoning to protect land around its in-town reservoirs and aquifer recharge area. In addition Southampton has water supply zoning to protect the Tighe-Carmody Reservoir.

Holyoke owns about half of the watershed surrounding the Tighe-Carmody reservoir. A relatively small percentage of the watershed is owned surrounding the in-town reservoirs.

Because of somewhat heavy recreational use of the in-town reservoirs a filtration plant may be required for those reservoirs.

Holyoke, along with Easthampton, Southampton, Westfield, and the PVPC has approved a Memorandum of Agreement for cooperative protection of the Barnes Aquifer, the main water source for the private wells not served by the Holyoke Water Works. This agreement establishes a committee to provide for intermunicipal review of all major development projects within the aquifer area, to coordinate uniform development of land use controls, and to be a forum for future educational or governmental action.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not Adopted*
New State Plumbing Code Enforcement: *Actively enforced*

Holyoke has not adopted specific zoning techniques to conserve water. The new state plumbing code is actively enforced. Holyoke does little to actively promote water conservation. A major source of unaccounted for water in Holyoke is unauthorized summer hydrant use. The Water Department has begun an educational program to explain the dangers of hydrant abuse. Holyoke has begun a systematic program to replace and upgrade meters. All commercial and industrial meters have recently been replaced.

Leak Detection

Leak Detection Program: *Adopted*

Holyoke owns its own leak detection equipment and repairs leaks as soon as possible. A leak detection audit was recently preformed. About 25% of Holyoke's water is reported unaccounted for.

Intermunicipal Connections

Holyoke has 186 miles of main 8" or greater. Holyoke abuts South Hadley, Chicopee, West Springfield, Westfield, Southampton and Easthampton, municipalities which have central water supply systems. There are 16 roadway junctions with the municipalities. The geography of the Connecticut River to the east and the Mt. Tom Range and East Mountain to the west and north limit the potential for interconnections. Holyoke has a projected surplus and is willing to sell water. It is participating in an MWRA study to determine the feasibility of becoming a supplemental source for the MWRA communities of Chicopee, South Hadley and Wilbraham. The engineering firm of Tighe and Bond is doing engineering studies to determine the feasibility of these interconnections. The results of this study are expected in late 1990. In addition, Holyoke also abuts the municipalities of Westfield, West Springfield and Easthampton, all of which have recently experienced contaminated supplies. Holyoke also has recently proposed a major capital improvement plan.

Holyoke has a regular connection with Southampton near the Westfield-Southampton line along Holyoke's transmission line. Emergency connections exist with West Springfield at Riverdale Road and Whitney Avenue. The Whitney Avenue connection has a small West Springfield line size. Potential connections are limited with Easthampton because of the geography of the Mt. Tom Mountain range. A road junction site exists along Rt 5. Easthampton lines extend to the town boundary at that site but Holyoke's lines would have to be extended. Further connections with Southampton are limited because of the limited nature of Southampton's distribution system. Potential connections are possible with Westfield from Holyoke's main distribution line. Water treatment is needed for these connections as the water that is transmitted through the distribution line is raw water. Further connections with West Springfield are limited because of East Mountain and the limited nature of West Springfield's supply lines in the area adjacent to the distribution line.

Holyoke has proposed plans to extend a 16" main along the Route 116 bridge when that bridge is re-constructed. The potential for that site is being further assessed in the MWRA study. This would allow a potential connection with South Hadley Fire District #1.

Holyoke has proposed plans to extend a 16" main along the Willimansett Bridge. This would allow a potential connection with Chicopee. This site is also being assessed by the MWRA study.

Regular Connection:

Service Agreement -	Southampton	

Emergency Connections:

Temporary short-term -	West Springfield -	Whitney Avenue Riverdale Road

Potential Connections:

Westfield -	off Holyoke's main distribution line
South Hadley -	Rte. 116 Bridge
Chicopee -	Willimansett Bridge

Water Emergencies:

Holyoke could reactivate the West Holyoke wellfield if necessary. The White Reservoir could be brought back on-line with capital improvement. For short term emergencies Holyoke could use the existing emergency connection with West Springfield.

Future Needs:

Holyoke needs to construct a 42" transmission line from the Tighe-Carmody Reservoir to fully utilize that source. A surface water filtration plant needs to be constructed.

Additional storage needs to be constructed as well as transmission line improvements to the West Heights area.

HUNTINGTON

Sources of Supply

The Huntington Water Department serves approximately 1000 residents, approximately 51% of the Towns population. The remainder of the population is served by individual on-site wells. The following sources are used.

Type/Name	Location	Capacity	Safe Yield
Cold Brook Reservoir	Off Route 20, Blandford	Not Available	.14 mgd.
Huntington wells #1 and 2	West Branch of Westfield River, Huntington	Not Available	.40 mgd. .54 mgd

The main sources of supply are wells #1 and #2. Water is pumped from these wells to the Cold Brook Reservoir which acts as a storage tank. In July 1988, a electrical storm damaged the wells' pumps and DEP issued a water emergency supply order. A recent study has been done which found that Huntington 's water supply was adequate to meet it's needs. In addition, there is potential for increased supply.

Water Demand

1988 Total Water Consumption: *46.7 mg.*
1988 Safe Yield: *.54 mgd.*
1988 Average Day Demand: *.13 mgd.*
1988 Maximum Day Demand: *.22 mgd.*

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	1,804	1,046	95	0.10	0.15	0.54
1988	1,980	1,010	127	0.13	0.22	0.54
1995	2,148	1,095	127	0.14	0.24	0.54
2000	2,179	1,111	127	0.14	0.24	0.54
2010	2,492	1,271	127	0.16	0.28	0.54

4,262 = Total population which could be served by 1988 safe yield

Pricing Policy

Water Pricing Policy: *Unmetered Flat Rate*
Water Rate: *$102/yr residential*
$158/yr commercial

Huntington charges residential users $102/year and commercial users $158 year through an unmetered flat rate. None of the approximately 400 services are metered. There are plans to move to a metered pricing structure but there is no definite timetable for that. The water rates reflect the

full cost of water. Water revenues are placed in a water receipts reserve account in the General Fund.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Not Adopted*

Huntington has adopted an Aquifer protection Zoning Bylaw. The land around Cold Brook Reservoir is not owned by the Town.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

Huntington has not adopted specific zoning regulations to conserve water. The town does not promote water conservation programs and has not replaced plumbing fixtures with water conserving devices in any municipal buildings.

Leak Detection

Leak detection: *Not actively pursued*

Huntington does not have a leak detection program or own its own equipment. It is interested in shared leak detection equipment with neighboring towns. A regular maintenance program has systematically repaired several large leaks with substantial water saving.

Intermunicipal Connections

Huntington has a relatively small distribution system located around the town center along Routes 20 and 112. Lines sizes are generally 8" and 10" decreasing to 4" at the system periphery, which has caused distribution problems. Huntington abuts two towns with central supply systems, Chester and Blandford at 5 roadway locations. The potential for a connection with Blandford is remote due to the large distance between distribution lines and a steeply sloped topography. Its connection with Chester along Route20 offers a greater potential, however lines would have to be extended a great distance and Chester's surplus supply is relatively small.

Huntington maintains a connection to the Springfield Regional Supply System to the 48" line which passes from the Littleville Reservoir to the Cobble Mountain Reservoir. The existing connection is for fire protection for the Gateway Regional High School and an elderly housing development.

This connection could be connected into an emergency connection but would require portable water treatment facilities as the Littleville Reservoir is untreated water.

Regular Connections:

Existing service arrangements:	Springfield (five protection purposes only)
Emergency Connections:	None
Potential Connections:	Springfield (48" distribution line)

Water Emergencies:

Huntington does not have an alternative source of supply. The Cold Brook Reservoir could supply an approximately 20-week supply if there was a disruption to the well supply.

Future Needs:

Huntington recently had a water needs study conducted by an engineering firm. That study identified the following needs: increase the size of the pumps; enlarge the feeder line from 4" to 8"; install three-phase power to the pumps; construct a storage tank and 12" main to the town center; increase the size of distribution lines (now 4"-6"); comply with the filtration requirement.

LONGMEADOW

Sources of Supply

Longmeadow purchases almost all of its water from the Springfield Regional Water System. A very small percentage of its residents still use private, on-site wells.

Water Demand

1988 Total Water Consumption: *931.7 mg.*
1988 Safe Yield: *Not applicable*
1988 Average Day Demand: *2.6 mgd.*
1988 Maximum Day Demand: *7.2 mgd.*

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	16,301	16,138	127	2.06	6.60	-- [1]
1988	16,768	16,600	154	2.55	7.20	
1995	16,596	16,430	154	2.53	7.13	
2000	17,845	17,666	154	2.72	7.66	
2010	19,131	18,940	154	2.91	8.21	

[1] No contractual upper limit has yet been established by the Springfield Regional System.

Pricing Policy

Water Pricing Policy: *Uniform Block Rate*
Water Rate: *$9.80/1000cu. ft.*

As of 1988, residents of Longmeadow are charged a uniform block rate of $.98 per 100 cubic feet of water. This water rate reflected the full cost of water delivery and system maintenance. At some time in the near future water rates will have to rise to respond to the water rate hike by the Springfield Regional Water System. Monies collected for water use are deposited in the General Fund. The community is considering adopting a water pricing policy designed to promote water conservation.

Protection Strategies

Water Supply Zoning: *None*
Land Acquisition Strategy: *Not Applicable*

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: None

The town does not have any water conservation programs in place.

Leak Detection

Leak Detection: Not actively pursued

Intermunicipal Connections

Longmeadow has 96 miles of mains greater than 8". It abuts the municipalities of East Longmeadow and Springfield. There are 5 road junction sites with these municipalities. Springfield's line to East Longmeadow is located in the northeast section of town. Longmeadow maintains a regular connection to the Springfield system near Forest Glen Road via a 16" line along Magawiska Lane from a 36" line from Provin Mountain.

Potential connections are limited. Forest Park limits the connections with Springfield to the north, the Connecticut River limits connections to the west. Lines do not extend to the boundary with East Longmeadow. East Longmeadow's Chestnut Street supply line from Springfield is in close proximity to a 10" line along Williams Street. An 8" line along Dickinson Street in Springfield is in close proximity to Longmeadow's 12" line on Converse Street. Further hydraulic analysis is required to fully determine the potential of these connections.

Regular Connections:

Permanent long term - Springfield - Forest Glen Road

Emergency Connections: None

Potential Connections: Limited

Water Emergencies:

No strategy for handling water emergencies has been developed.

Future Needs:

Longmeadow needs to replace inadequate transmission lines in some parts of town.

LUDLOW

Sources of Supply

The Town does not own or manage its own water supply. Approximately 80% of the Town's population is served by the Springfield Water Department. The remaining 20% of the population is served by individual, on-site wells. The water supplied to the town comes directly from the Ludlow Reservoir, which is owned by the Springfield Municipal Water Works. The Town is considered a part of the Springfield system, not a buyer from the system. Ludlow users are charged the same amount for water as Springfield users and are charged directly by the Springfield Water Department.

Type/Name	Location	Capacity	Safe Yield
Ludlow Reservoir	Ludlow	2,000 mgd	7 mgd

Water Demand

1988 Total Water Consumption: *739.6 mg*
1988 Safe Yield: *7.0 mgd*
1988 Average Day Demand: *2.0 mgd*
1988 Maximum Day Demand: *6.3 mgd*

Ludlow currently has a safe yield of 7 mgd, and an average daily consumption of 2 mgd, giving it a surplus of 5 mgd.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	18,150	14,520	87	1.26	3.60	5.60
1988	19,140	15,312	132	2.03	6.30	7.00
1995	19,281	15,425	132	2.04	6.35	7.00
2000	21,537	17,229	132	2.28	7.09	7.00
2010	24,359	19,487	132	2.58	8.02	7.00

52,896 = Total population which could be served by 1988 safe yield

Pricing Policy

Water Pricing *Policy: Flat Rate*
Water Rate: *$10.90/1,000 cubic feet*

Residents of the Town of Ludlow pay the same rates for water as the residents of Springfield.

Protection Strategies

Water Supply Zoning: *In progress*
Land Acquisition Strategy: *Adopted*

The Springfield Municipal Water Department owns approximately 2200 acres of Ludlow Reservoir watershed land.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not Adopted*

The town does not have any water conservation programs in place.

Leak Detection

Leak Detection: Actively pursued

The Springfield Water Department has its own leak detection equipment and maintains an active leak detection program.

Intermunicipal Connections

Ludlow has 76 miles of main 8" or greater. It abuts the following municipalities with central water supply systems: Belchertown, Wilbraham, Springfield, Chicopee, and Palmer. The Chicopee Valley Aqueduct is located in Ludlow along Center Street as it transmits water to the Nash Hill Reservoir. Distribution lines extend from the Nash Hill Reservoir to South Hadley and Chicopee. The Wilbraham supply line from the Chicopee Valley Aqueduct is located along Miller St. A 30" supply line from the Springfield Reservoir crosses Ludlow near Shawnigan Drive.

Ludlow does not maintain regular connections with other municipalities.

An emergency connection exists with the Springfield system near Shawnigan Drive. A previous connection with the Springfield System of Indian Leap Street was inactivated when a tressel across the Chicopee River was removed in 1988. An emergency connection with Wilbraham at Miller Street was recently removed.

Ludlow has a high ADD to MDD ratio. The ADD is approximately 2 mgd, the MDD is approximately 6 mgd. The safe yield of the system is 7 mgd. This high ratio limits the ability of the Springfield Reservoir to be a supplemental supply.

There is, however, potential to provide short-term emergency supplies, especially to the MWRA through the Chicopee Valley Aqueduct. An elevation difference between the Springfield Reservoir and the Nash Hill Reservoir means a pump is required to supply that source. A connection could be re-established with Wilbraham. Other connections with Wilbraham are limited by the Chicopee River. Lines doe not extend in close proximity to the Palmer or Belchertown systems.

Regular Connections: *None*
Emergency Connections: *Springfield* - Shawnigan Drive
Potential Connections: *MWRA* - Miller Street

Water Emergencies

The large capacity of the Ludlow Reservoir is considered sufficient to handle water emergencies.

Future Needs

As the population increases, Ludlow will have to increase the size of its transmission lines.

MIDDLEFIELD

Sources of Supply

There is no public water supply system in Middlefield. Ninety-five percent of the population is served by individual on-site wells. The remaining five percent is served by a private community well. There are no known potential sources of public water supply available to Middlefield and no plans to develop a public water system.

Water Demand

Not available

Pricing Policy

The full cost of water is assumed by each user.

Protection Strategies

Water Supply Zoning: *None*
Land Acquisition: *None*

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *None*

Leak Detection

Not Applicable

Intermunicipal Connections

Existing: *None*
Potential: *None*

Water Emergencies

There is no strategy to deal with water emergencies.

Future Needs

Middlefield does not anticipate any significant change in its water supply needs within the foreseeable future.

MONSON

Sources of Supply

Sixty-eight percent (68%) of the population of Monson is served by public supply. The remaining residents are supplied by private, on-site wells. The Town of Monson maintains the following water sources:

Type/Name	Location	Capacity	Safe Yield*
Well #1	Bethany Road	.489 mgd	.49 mgd
Well #2	Palmer Road	.756 mgd	.76 mgd
Well #3	Bunyan Road	1.00 mgd	1.00 mgd
			2.25 mgd

*limited by capacity

Water Demand

1988 Total Water Consumption: *255.9 mg*
1988 Safe Yield: *2.25 mgd*
1988 Average Day Demand: *.7 mgd*
1988 Maximum Day Demand: *1.2 mgd*

Monson had an average daily demand of .7 mgd and a safe yield of 2.25 mgd giving it a surplus of 1.05 mgd in 1988.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	7,315	4,974	190	0.94	1.50	2.25
1988	8,000	5,440	128	0.70	1.20	2.25
1995	8,088	5,500	159[1]	0.88	1.50	2.25
2000	8,925	6,069	159	0.97	1.66	2.25
2010	10,267	6,982	159	1.11	1.91	2.25

14,136 = Total population which could be served by 1988 safe yield

[1] The projected demand is based on an average of 1980 and 1988 gpcd.

Pricing Policy

Water Pricing Policy: *Declining Block Rate*
Water Rate: *20,000 gals or any part thereof $35.00 minimum charge*

next 30,000 gals or any part thereof.....$ 00.75/million gal.

next 50,000 gals or any part thereof.....$ 00.70/million gal.
next 200,000 gals or any part thereof.....$ 00.60/million gal.
next 200,000 gals or any part thereof.....$ 00.50/million gal.
next 500,000 gals or any part thereof.....$ 00.40/million gal.

above 1,000,000 gals .....$ 00.30/Mgal

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Adopted*

The Monson Water Department owns approximately 47 acres of recharge area land around its wells.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not Adopted*

The town does not have any water conservation programs in place.

Leak Detection

Leak Detection: *Not Adopted*

The Monson System has very high pressure. A leak produces a noticeable drop in pressure which is repaired by the Water Department.

Intermunicipal Connections

Monson has 12 miles of main 8" or greater. Monson's water distribution system is located around Rt. 32 and the center of town. Monson abuts 2 towns, Wilbraham and Palmer with central supply systems, at 9 roadway junctions. Monson's lines extend to the town boundary in only two locations:
There are no existing regular or emergency connections.
Monsons lines (6") extend to the boundary in two location with Palmer FD#1 at State Avenue-Bridge Street and Palmer Road-Main Street. The greatest barrier to an interconnection with FD#1 is the pressure differential between the two systems. Monsons pressure in that location is 175 lbs. while FD#1's is 80 lbs.

Regular Connections: None

Emergency Connections: None

Potential Connections: Palmer-FD#1 - State Avenue

Water Emergencies

Conant Pond, with a capacity of 2.5 mgd is considered to be an adequate emergency supply but has been unused since the 1960's. It could only be used after approval by DEP.

Future Needs

In order to accommodate increased development the Town of Monson will need additional pumping capacity and larger transmission lines.

MONTGOMERY

Sources of Supply

There is no public water supply system in Montgomery. The entire population is served by individual on-site wells. The Westfield Reservoir is a potential source of public water supply. However, the Town has no plans to develop a public water system at this time.

Water Demand

Not available

Pricing Policy

The full cost of water is assumed by each user.

Protection Strategies

Water Supply Zoning: *Not Adopted*
Land Acquisition: *Not Adopted*

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *None*

Leak Detection

Not Applicable

Intermunicipal Connections

Existing: *None*
Potential: *None*

Water Emergencies

There is no strategy to deal with water emergencies. However, it is possible that a connection to the Westfield Reservoir could be created. In order to do this, transmission lines would have to be installed and the water would need proper treatment.

Future Needs

Montgomery does not anticipate any significant change in its water supply needs within the foreseeable future.

NORTHAMPTON

Sources of Supply

Northampton's public water system serves 100% of the City's population and is operated by the Northampton Water Department. The city is supplied by the following sources:

Name/type	Location	Capacity	Safe Yield
SP Ryan Reservoir West Whately	Off Conway Rd,	750mg	5.5mgd
Lower West Whately Reservoir	Off Conway Rd, West Whately	10mg	-
Mountain St Reservoir	Off Mountain St, Williamsburg	350 mg	3.4mgd
Clark St Wells(2) (gravel packed)	Florence	-	1.0mgd
Spring St. Well (gravel packed)	Florence	-	.9mgd
			10.8mgd

The Ryan-West Whately-Mountain Street Reservoir complex is the city's primary water source. The Florence wells are primarily used to supply even pressure throughout the system. A previous source of supply, the Roberts Meadow Reservoir complex, (off Reservoir Road, Leeds, 2.5mgd safe yield) requires a treatment facility and is only used in periods of excessive demand, such as for fire protection. Plans call for it to be taken off line. A recent water supply study calls for $24 million in improvements to the system to install an new pipeline from the Ryan reservoir to the Leeds distribution system to improve pressure and isolate the Whately and Mountain Street reservoirs. There are no immediate plans for new well supplies.

Water Demand

1988 total water consumption:	*1,627 mg*
1988 safe yield:	*10.8 mgd*
1988 Average Day Demand:	*5.4 mgd*
1988 Maximum Day Demand:	*6.0 mgd*

Northampton has a surplus of 5.4 mgd. The surplus is expected to be 4.5 mgd by the year 2000.

Supply and Demand Summary and Projections[1]

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	29,286	29,257	127	3.7	4.00	9.86
1988	30,486	30,456	139	4.23	5.97	10.8
1995	32,100	32,068	--	--	--	10.8
2000	33,000	32,967	142	4.68	6.28	10.8
2010	34,150	34,116	--	--	--	10.8

70,935 = Total population which could be served by 1988 safe yield

1 From Water Supply Treatment and Distribution Report, Anderson Nichols 1989.

Pricing Policy

Water Pricing Policy: *Uniform block rate*
Water Rate: *$8.50/1000 cu ft.*

Northampton charges $8.50/1000 cu ft through a uniform block rate structure. Except for the municipal users 100% of the 8,088 services are metered. An enterprise account has been established. The price structure reflects the full cost of water.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Adopted*

Northampton has adopted a water supply overlay district to protect its water resource. The town owns a great deal of the watershed land around both the Mountain St. and West Whately reservoirs. A low salt policy is in effect around the two well sites. The watershed around the West Whately reservoirs is owned by D.E.M. (Conway State Forest). Only a small percentage of land is owned around the two wells. A City inter-departmental Committee has been formed to devise an overall water supply protection strategy.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*
Plumbing Code Enforcement: *Actively enforced*

Northampton has not adopted specific zoning regulations to conserve water. The new state plumbing code is actively enforced. The town does not actively encourage water conservation through educational material or distribution or installation of water saving devices. Plumbing fixtures with water conserving devices have not been replaced in any municipal buildings.

Leak Detection

Leak detection: *Not actively pursued*

Northampton has not developed a leak detection program and has no immediate plans to do so.

Intermunicipal Connections

There are 130 miles of mains 8" or over in Northampton. Northampton abuts 4 towns with central water supply systems. There are 18 road junction sites between these 4 towns.

Northampton does not have any regular connections. Northampton maintains emergency connections with Hatfield and Easthampton. The connection with Hatfield was used in May of 1990 when Hatfield had a water emergency. There is no written agreement between Northampton and Hatfield. There is a written agreement between Northampton and Easthampton. The lines are on opposite sides of the highway at the Hatfield connection. Temporary lines were laid in a culvert to make the connection. With the Easthampton connection Northampton experiences low pressure in that area. Temporary pumping facilities are required.

There are 5 roadway junctions with Williamsburg. The junction along Route 9 offers the greatest potential for an emergency interconnection. The main limitation to that site is the low pressure Northampton experiences at that site and the small line size in Williamsburg.

Northampton has a proposal to improve its distribution system. One component of the improvement is to enlarge the main distribution line from the Mountain Street Reservoir. The new line is proposed to go along Mountain Street and Route 9 in Williamsburg. A potential exists for the installation of a permanent emergency connection with these improvements.

There is one roadway junction with Hadley at the Coolidge Bridge along Route 9. Lines would need to be extended across the Connecticut River limiting the potential of this site. There are no other potential sites with Hatfield. There are potential road connections with Easthampton at 9 locations. Six of there sites have no common lines. For the three sites that are possibilities, Glendale Road, Florence Road and Route 5, the one with the greatest potential is the Florence Road site. Lines extend to the Town boundary and line sizes are similar. There is a pressure differential which would need to be corrected.

Regular Connections:	None
Emergency Connections:	
Temporary Short Term:	Hatfield - King Street Easthampton - Easthampton Road
Potential Connections:	Easthampton - Florence Road Williamsburg - Haydenville Road

Water Emergencies

Northampton can increase use of the Clark and Spring St. wells in times of an emergency. For a long term problem the Roberts Meadows Reservoir complex could be re-activated. There are several potential emergency interconnections with Easthampton, Hatfield, and Williamsburg which could be used to supplement supplies during a short emergency.

Future Needs

Northampton needs to construct a new transmission line from the West Whately Reservoir system. A filtration facility needs to be constructed for the main supply. A 2000' concrete water way needs to be constructed to connect the West Whately Reservoir with the Mt. Street Reservoirs.

PALMER

Sources of Supply

Water services in Palmer are provided by four separate, publicly-owned water districts: Palmer Village/ District # 1, Thorndike, Three Rivers and Bondsville. Each district has its own pricing policy and billing system. Three of the four districts have their own water supplies.

PALMER VILLAGE DISTRICT #1

Type/Name	Location	Capacity	Safe Yield
Graves Brook Upper & Lower Reservoirs	Breckenridge St.	24 mg	.38 mgd
Well # 1 (19 wells-closed due to contamination)	Off Salem Road near Galaxy St.	---	(.40) mgd
Well # 2	Off Salem Road	---	.72 mgd 1.5 mgd

The total safe yield of the system has been reduced to 1.1 mgd since 1980 due to the closing of the Galaxy Well Field because of organic pollutant contamination. It is expected that this well field will be reopened in 1990 upon completion of a granular activated charcoal treatment plant currently under construction at the well field site.

THORNDIKE

The Thorndike Fire and Water District purchases its water from the Village of Bondsville. 100% of the Thorndike population is served by this source. There are no additional known sources of supply potentially available to Thorndike.

THREE RIVERS

The Three Rivers public water supply serves 99% of the Village population and is owned and operated by the Three Rivers Fire and Water District. The remaining 1% of the population receives its water from private, on-site wells.

Type/Name	Location	Capacity	Safe Yield
Well # 1	Rt. 181 near Ware River (West)	n.a.	.30 mgd
Well # 2	Oak Street	n.a.	.20 mgd
Well # 3	Rt. 181 (East)	n.a.	.58 mgd 1.08 mgd

BONDSVILLE

The Bondsville Fire and Water District supplies 95% of the Bondsville population. The remaining 5% is served by private, on-site wells.

Type/Name	Location	Capacity	Safe Yield
Well # 1	Jabish Brook Belchertown	n.a.	.14 mgd
Well # 2	Jabish Brook Belchertown	n.a.	.19 mgd
Well # 3	Jabish Brook Belchertown	n.a.	.36 mgd .69 mgd

Water Demand

PALMER VILLAGE DISTRICT #1

1988 Total Water Consumption: *240.4 mg*
1988 Safe Yield: *1.1 mgd*
1988 Average Day Demand : *.68 mgd*
1988 Maximum Day Demand: *1.2 mgd*

Supply and Demand Summary and Projections - Palmer Village

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	11,389	5,467	124	0.68	1.00	1.1
1988	12,120	5,818	113	0.66	1.20	1.1
1995	12,328	5,918	113	0.67	1.22	1.1
2000	12,595	6,046	113	0.68	1.25	1.1
2010	13,600	6,528	113	0.74	1.35	1.1

9,716 = Population which could be served by 1988 safe yield in the Palmer Village District

THORNDIKE

1988 Total Water Consumption: *55 mg*
1988 Safe Yield: *N/A*
1988 Average Day Demand: *.133 mgd*
1988 Maximum Day Demand: *.193 mgd*

Supply and Demand Summary and Projections - Thorndike

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	11,389	1,367	110	0.15	0.33	N/A
1988	12,120	1,454	104	0.15	0.19	
1995	12,328	1,479	104	0.15	0.20	
2000	12,595	1,511	104	0.16	0.20	
2010	13,600	1,632	104	0.17	0.22	

BONDSVILLE

**1988 Total Water Consumption:* *74.9 mg*
1988 Safe Yield: *.69 mgd*
1988 Average Day Demand: *.205 mgd*
1988 Maximum Day Demand: *.539 mgd*

* *41.4 mg purchased from Thorndike*

Supply and Demand Summary and Projections - Bondsville

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	11,389	1,253	144	0.18	0.21	0.69
1988	12,120	1,333	152	0.20	0.54	0.69
1995	12,328	1,356	152	0.21	0.55	0.69
2000	12,595	1,385	152	0.21	0.56	0.69
2010	13,600	1,496	152	0.23	0.60	0.69

4,537 = Population which could be served by 1988 safe yield in the Bondsville District

THREE RIVERS

1988 Total Water Consumption: *138.65 mg*
1988 Safe Yield: *1.08 mgd*
1988 Average Day Demand: *.38 mgd*
1988 Maximum Day Demand: *.54 mgd*

Supply and Demand Summary and Projections - Three Rivers

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	11,389	3,417	118	0.40	0.49	0.53
1988	12,120	3,636	105	0.38	0.54	1.08
1995	12,328	3,698	105	0.39	0.55	1.08
2000	12,595	3,779	105	0.39	0.56	1.08
2010	13,600	4,080	105	0.43	0.61	1.08

10,334 = Population which could be served by 1988 safe yield in the Three Rivers District

Pricing Policy

PALMER VILLAGE: *Uniform Block Rate*
$18/1000 cu. ft.

THORNDIKE: *Uniform Block Rate*

THREE RIVERS: *Uniform Block Rate*
$20/1000 cu. ft.

BONDSVILLE:

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Adopted*

The Town of Palmer has adopted water supply protection overlay district zoning that applies to all four village districts. In addition, a land acquisition strategy for water protection is in place. The Three Rivers district has been successful in purchasing land around its wells. Bondsville has an on-going cooperative arrangement with the Belchertown Selectmen to discuss and implement water protection strategies.

Conservation Programs

Zoning Regulations for Water Conservation: *Not adopted*

The Town has not enacted any zoning regulations that specifically address water conservation issues.

Leak Detection

Leak Detection Programs: *Actively Pursued*

All four water districts have leak detection programs in place.

Intermunicipal Connections

Palmer is divided into 4 separate supply systems. The Three Rivers Fire District has 11 miles of main 8" or greater, Palmer Fire District #1 has 16 miles of main 8" or greater, Bondsville Fire and Water District has 6.5 miles of main 8" or greater, and Thorndike Fire and Water District has 10 miles of main 8" or greater. Currently negotiations are underway to link all four water districts.

THREE RIVERS

The Three Rivers system does not maintain a regular connection with any municipality or system. An emergency connection is maintained with Thorndike on Main Street. The Three Rivers system extends to the town boundary in 3 locations. None of the abutting towns of Belchertown or Monson have lines in those areas. The line does not extend from Palmer to join with the Wilbraham system along Springfield Street or Baptist Hill Road.

Regular Connections: None

Emergency Connections: Thorndike - Main Street

Potential Connections: Bondsville - Route 181

THORNDIKE

Water distribution maps were unavailable for review. Thorndike maintains a regular connection with Bondsville along Pleasant Street and an emergency connection with Three Rivers along Main Street.

Regular Connections: Bondsville - Pleasant Street

Emergency Connections: Three Rivers - Main Street

Potential Connections: Data unavailable

BONDSVILLE

Water distribution maps were unavailable for Bondsville. Bondsville maintains a regular connection with Thorndike along Pleasant Street.

Regular Connections: Thorndike - Pleasant Street

Emergency Connections: Data unavailable

Potential Connections: Data unavailable

PALMER DISTRICT #1

Water distribution maps were unavailable for Palmer District #1.

Future Needs

PALMER VILLAGE: This district needs to develop an additional source of water, clean and reline its transmission lines, and construct a treatment plant at the Grave Brook Reservoir.

THREE RIVERS: The district needs to develop additional sources of water, clean and refurbish its pumps, and develop chlorination and corrosion control facilities.

PELHAM

Sources of Supply

There is no public water supply system in Pelham. Approximately 30% of the population is supplied by the neighboring town of Amherst and is subject to the limitations of that system. The remaining 70% of the population is served by private, on-site wells. There is a potential for developing ground water as a public source of supply if this should become necessary.

Water Demand

Not available

Pricing Policy

For those supplied by individual wells, the full cost of water is assumed by each user. Other users are billed by the Town of Amherst at the same rates as Amherst residents. The pricing policy of the Amherst system reflects the full cost of the water system.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Not Adopted*

The Town of Pelham has adopted a water supply protection overlay district with appropriate zoning controls. In addition, the Town has hazardous materials controls and a restrictive roadsalt policy.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: Not Adopted

Leak Detection

Not Applicable

Intermunicipal Connections

Pelham has regular connections with Amherst at Harkness Road and Amherst Road. These connections are made to Amherst's 2 12" supply lines from the Hill, Hawley and Intake Reservoir.

There is little potential to develop emergency interconnections with abutting towns.

Regular Connections:
Service Arrangement: Amherst

Emergency Connections: None

Potential Connections: Limited

Water Emergencies

There is no strategy to deal with water emergencies.

PLAINFIELD

Sources of Supply

There is no public water supply system in Plainfield. The entire population is served by individual on-site wells. There are no known potential sources of public water supply available to Plainfield and no plans to develop a public water system.

Water Demand

Not available

Pricing Policy

The full cost of water is assumed by each user.

Protection Strategies

Water Supply Zoning: *Not adopted*
Land Acquisition Strategy: *Not adopted*

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

Leak Detection

Not Applicable

Intermunicipal Connections

Existing: *None*
Potential: *None*

Water Emergencies

There is no strategy to deal with water emergencies.

Future Needs

Plainfield does not anticipate any significant change in its water supply needs within the foreseeable future.

RUSSELL

Sources of Supply

Approximately 85% of the Town's population is served by the Russell Water Department. The remaining 23% of the population is served by individual, on-site wells. The Russell Water Department uses the following sources:

Type/Name	Location	Capacity	Safe Yield
Black Brook Resvoir Blandford	Martin Phillips Rd.	n.a.	.40 mgd
Well # 1	Near Route 20	n.a.	.15 mgd .55 mgd

Water Demand

1988 Total Water Consumption:	*152 mg*
1988 Safe Yield:	*.55 mgd*
1988 Average Day Demand:	*.42 mgd*
1988 Maximum Day Demand:	*.67 mgd*

Russell currently has a safe yield of .55 mgd, and an average daily consumption of .42 mgd, giving it a surplus of .13 mgd.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	1,570	1,209	188	0.23	0.25	0.55
1988	1,680	1,394	299	0.42	0.67	0.55
1995	1,683	1,397	299	0.42	0.67	0.55
2000	1,880	1,560	299	0.47	0.75	0.55
2010	2,138	1,775	299	0.53	0.85	0.55

1,839 = Total population which could be served by 1988 safe yield

Pricing Policy

Water Pricing Policy:	*Unmetered Flat Rate*
Water Rate:	*$33 per quarter*

The Russell pricing policy reflects the full cost of water. Money raised by the Water Department is deposited in the General Fund. The Town is interested in adopting a pricing policy designed to promote water conservation.

Protection Strategies

Water Supply Zoning:	*Not Adopted*
Land Acquisition Strategy:	*Adopted*

The Town owns approximately 2600 acres of watershed land. No development is allowed on this land.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

The town does not have any water conservation programs in place.

Leak Detection

Leak Detection: Actively pursued

Russell has been accepted into the State funded Leak Detection Program. In 1988 67,254,604 gallons of water pumped from Town supplies was unaccounted for. This constitutes 44% of the total amount pumped.

Intermunicipal Connections

Russell has 4.5 miles of main 8" or greater. Russell abuts 3 municipalities, Westfield, Blandford and Granville, with central supply systems at 8 roadway junction sites. Russell's distribution system is concentrated along Route 20.
There are no existing regular or emergency connections. Potential emergency connections are limited without the extension of line. The site with the greatest potential is the Route 20 junction with Westfield. At that site Westfield's 8" line extends to the town boundary. Russell however would need to extend line a substantial distance.

Regular Connections: None

Emergency Connections: None

Potential Connections: Limited

Water Emergencies

Russell does not have redundant supplies that can be used for emergencies.

Future Needs

The Town needs to replace four inch transmission lines with eight inch lines in order to solve pressure problems in some sections of town.

SOUTH HADLEY DISTRICT #1

Sources of Supply

South Hadley has two separately owned and operated water supply districts. South Hadley Fire District #1 serves the southern two-thirds of the town while South Hadley Fire District #2 serves the northern one third.

Fire District #1 serves approximately 13,200 of the estimated 17,700 residents of South Hadley. Fire District #1 purchases all of its water from the Massachusetts Water Resources Authority (MWRA). The water is supplied from the Quabbin Reservoir via the Chicopee Valley Aqueduct. Fire District #1 has a 45-year contract with the MWRA, which expires in 1988, to pump up to 3.8 mgd.

Fire District #1 abandoned the Leaping Well Reservoir and Buttery Brook Reservoir because of poor water quality and inadequate supplies. These reservoirs are used for recreation. The Leaping Well Reservoir has the potential for renovation. Adequate groundwater sources have not been identified.

The supply and cost of water will be affected by the new MWRA contract. Costs are expected to increase substantially.

Water Demand

1988 Total Water Consumption:	839.7 mg
1988 Safe Yield:	3.8mdg
1988 Average Day Demand:	2.3mdg
1988 Maximum Day Demand:	3.9mdg

South Hadley Fire District #1 had an average day consumption in 1988 of 2.3 mgd. This is well below the 3.8 mgd allowable pumping level. However the maximum day consumption in 1988 was 3.9 mgd, above the allowable level.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	16,399	11,807	183	2.19	3.60	3.8
1988	17,696	13,272	173	2.30	3.90	3.8
1995	18,311	13,734	178[1]	2.45	4.15	3.8
2000	19,208	14,406	178	2.57	4.35	3.8
2010	21,548	16,161	178	2.88	4.88	3.8

21,328 = Total population which could be served by 1988 safe yield

1 Demand projections are based on an average of 1980 and 1988 gpcd.

Pricing Policy

Water Pricing Policy: *Declining Block Rate*
Water Rate: *$10 minimum charge for first 1200 cu ft*
$7.00/1000 cu ft for 1,200-4,000 cu ft/quarter/family unit
$5.40/1000 cu ft for over 4,000 cu ft/quarter/family unit

South Hadley Fire District #1 customers are billed quarterly on a declining block rate as listed above. 100% of the 3,797 are metered. Meters are replaced continuously as needed. Water rates reflect the full cost of water. Revenues are reserved for the Water Department in the General Fund. South Hadley Fire District #1 anticipates changing its pricing policy to a flat rate or increasing block rate but no timetable has been established.

Protection Strategies

Water Supply Zoning: *Not Applicable*
Land Acquisition Strategy: *Not Applicable*

South Hadley Fire District #1 depends on protection strategies at Quabbin Reservoir for it's water quality protection.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*
New State Plumbing Code Enforcement: *Actively enforced*

South Hadley Fire District #1 has not adopted specific zoning regulations to conserve water. The new state plumbing code for water conserving plumbing fixtures is actively enforced. Water saving plumbing fixtures have been replaced in some municipal buildings. A public education on water conservation is included with the water bill.

Leak Detection

Leak detection: *Actively pursued*

The MWRA recently conducted a leak detection survey in South Hadley. South Hadley Fire District #1 has leak detection equipment. Water which was unaccounted for totaled 129 mg (15% of total consumption) in 1988.

Intermunicipal Connections

South Hadley Fire District #1 has 54 miles of main 8" or greater. It abuts Holyoke, Chicopee, and South Hadley Fire District #2, which have central supply systems. The main supply line from the Nash Hill Reservoir, from the Chicopee Valley Aqueduct, is located near New Ludlow Road.

South Hadley Fire District #1 maintains a regular connection with Granby along New Ludlow Road. South Hadley First District #1 maintains emergency connections with South Hadley Fire District #2 along College Street, Ferry Street, East Street, Parkview Drive, and Cypress Drive. An emergency connection is maintained with Chicopee at New Ludlow Road. There is no formal written agreement between either South Hadley Fire District #1 or Chicopee. Potential connections are being assessed by Tighe & Bond Engineering as part of the MWRA study to determine the feasibility of supplemental supply sources. A potential connection is being assessed from Holyoke

along the Willimansett bridge. The South Hadley Fire District #1 line size is 6" in that area. A fluoridation difference would have to be resolved for this connection. There are further roadway junction sites with Chicopee at Montcalm Street, Willimansett Street, New Ludlow Road, and Main Street - Chicopee Street. Lines extend to the municipal boundaries from both municipalities at all but the Main Street site. Lines are typically 6" and 8". While these are possible connection sites further study of the system hydraulics is required to determine the usefullness of these connections. There are no additional connection sites with South Hadley Fire District #2.

Regular Connections:

Permanent Long Term: MWRA
Granby - New Ludlow Road

Emergency Connections: Chicopee - New Ludlow Road
South Hadley Fire District #2 - College Street
Ferry Street
East Street
Parkview Drive
Cypress Drive

Potential Connections: Holyoke - Rt. 116 Bridge
Chicopee - Mantrelin Street

Water Emergencies

In an emergency, South Hadley Fire District #1 is able to receive emergency supplies from South Hadley Fire District #2 and Chicopee

Future Needs

South Hadley Fire District #1 needs to explore alternative sources of supply.

SOUTH HADLEY DISTRICT # 2

Sources of Supply

Fire District No. 2 is a separately owned water supply district serving approximately 4,500 (25%) of the Town's estimated 17,700 population in the northern section of Town. FD #2 also serves a small portion of neighboring Granby's population. FD #2 uses the following sources:

Type/Name	Location	Capacity	Safe Yield
Lythia Springs Reservoir	Off Lythia Springs Road	35mg	.25 mgd
Dry Brook Well	Off Route 47	----	1 mg
Elmer Brook Wells 1 & 2 (dug wells)	Off Pearl St.	----	.4 mg 1.65 mgd.

The main source of supply for FD #2 is the Dry Brook Well. The Dry Brook Well aquifer reportedly could supply a much larger amount (estimated 3mgd). Studies are currently being done to locate a new source of supply, possibly a new well adjacent to Dry Brook Well.

Water Demand

1988 Total Water Consumption:	186mg
1988 Safe Yield:	1.65 mgd
1988 Average Day Demand:	.51 mgd
1988 Maximum Day Demand:	1.0 mgd

South Hadley FD #2 currently has a surplus of .65 mgd. The surplus is expected to be .57 mgd by the year 2000.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	16,399	4,592	112	0.51	1.02	1.65
1988	17,696	4,424	115	0.51	1.00	1.65
1995	18,311	4,578	115	0.53	1.03	1.65
2000	19,193	4,798	115	0.55	1.08	1.65
2010	21,521	5,380	115	0.62	1.22	1.65

14,324 = Total population which could be served by 1988 safe yield

Pricing Policy

Water Pricing Policy:	*Uniform Block Rate*
Water Rate:	*$8.50/1000 cu.ft*

South Hadley FD #2 charges $8.50/ 1,000 cu ft. through a uniform block rate. One hundred percent of the 1,372 services are metered. The price structure reflects the full cost of water. An enterprise account has been established.

Protection Strategies

Water Supply Zoning: *Not Adopted*
Land Acquisition Strategy: *Not Adopted*

South Hadley FD #2 has not adopted water supply protection zoning and none is currently proposed. The Fire District owns a large amount of the watershed land surrounding Lythia Springs Reservoir and 4.5 acres around Dry Brook Well. There is, however, no current acquisition strategy to purchase more land around any source.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not Adopted*
New State Plumbing Code Enforcement: *Actively enforced*

South Hadley has not adopted specific zoning regulations to conserve water. South Hadley FD #2 encourages water conservation by sending an educational brochure on water conservation with the bill. The new state plumbing code is actively enforced in all new buildings. Water conserving plumbing devices have not been replaced in any buildings.

Leak Detection

Leak Detection Program: *Actively pursued*

South Hadley FD #2 owns its own leak detection equipment and has developed an active leak detection program.

Intermunicipal Connections

South Hadley Fire District #2 has 21 miles of main 8" or greater. It abuts Hadley, Amherst, and South Hadley Fire District #1 which have central supply systems. A regular connection exists with Granby along Route 116 to supply those Granby residents who live along the highway.
Emergency connections exist with South Hadley Fire District #2 at College Street, Ferry Street, East Street, Parkview Drive, Cypress Drive. These connections can go both ways. There is no written agreement between the two fire districts.

There are no further connection sites with South Hadley Fire District #1. Connections with Amherst and Hadley are limited by the topography of the Holyoke Mountain Range. Lines extend to the boundary from Hadley along the roadway site at Rt. 47. South Hadley Fire District #2 lines would need to be extended at that site.

Regular Connections:
Service Agreement: Granby - Rt. 116

Emergency Connections: South Hadley Fire District #1 - College Street
Ferry Street
East Street
Parkview Drive
Cypress Drive

Potential Connections: Limited

Water Emergencies

South Hadley FD #2 has an agreement with FD #1 to receive water during an emergency.

Future Needs

South Hadley FD #2 needs to develop a new source to meet expected long range demand. FD #2 needs to continue to work towards developing a comprehensive water supply protection bylaw.

SOUTHAMPTON

Sources of Supply

Southampton's public water supply system, owned and operated by the Southampton Water Department, serves almost 40% of the Town's estimated 4,610 population. The remainder of the population is served by individual on site wells. The Southampton Water Department uses the following sources:

Type/Name	Location	Capacity	Safe Yield
Tighe-Carmody Reservoir (Holyoke) (Also called Manhan)	Off Former Rd., Southampton	4,850mg	.22mgd
College Highway Well (gravel)	College Highway north, off Glendale Road	-	.36mgd .58mgd

Southampton's main water source is Holyoke's Tighe-Carmody Reservoir. Southampton is entitled to receive up to 125 gpcd (gallons per capita per day) up to a maximum volume of 650,000 gpd free of charge. This agreement was established when the reservoir was constructed to serve Holyoke. Southampton used 117,000 gpd (65 gpcd) from Holyoke in 1988, well below the established maximum amount. The volume of use is limited by the 6" transmission lines running from the main Holyoke supply lines.

The College Highway well is used about 10 hours per day with a higher usage during peak demand.

Southampton owns an additional well, (estimated safe yield .5mgd), in the Hampton Ponds area which is not used.

Southampton's water system is limited by pipe size. All of the older mains are 6".

Water Demand

1988 Total Water Consumption:	*58 mg*
1988 Safe Yield:	*.58mgd*
1988 Average Day Demand:	*.16mgd*
1988 Maximum Day Demand:	*.21mgd*

Southampton currently has a surplus of .42 mgd. The surplus is expected to be .39 mgd in the year 2000.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	4,137	1,655	68	0.11	0.14	0.47
1988	4,610	1,798	88	0.16	0.21	0.58
1995	5,055	1,971	88	0.17	0.23	0.58
2000	5,530	2,157	88	0.19	0.25	0.58
2010	6,690	2,609	88	0.23	0.30	0.58

6,562 = Total population which could be served by 1988 safe yield

Pricing Policy

Water Pricing Policy: *Unmetered flat rate*
Water Rate: *$64/6 month period*

Southampton charges $128/yr. through an unmetered flat rate. None of the 350 services are metered. There are no immediate plans to install meters. Preliminary discussions are occurring to raise the rate to $140/yr. to meet rising operational costs. The current price structure reflects the full cost of water. An enterprise account has been established.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Adopted*

Southampton recently adopted a water supply protection bylaw to protect the water supply around both the College Highway Well and the Tighe-Carmody Reservoir.

Southampton also received a $425,000 grant through the Massachusetts D.E.P./Aquifer Land Acquisition Program to protect land surrounding the College Highway Well.

Southampton, along with Easthampton, Holyoke, Westfield, and the PVPC, has approved a Memorandum of Agreement for cooperative protection of the Barnes Aquifer, the main water source for these municipalities. This agreement establishes a committee to provide for intermunicipal review of all major development projects within the aquifer area, to coordinate uniform development of land use controls, and to be a forum for future educational or governmental action.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

Southampton has not adopted specific zoning regulations to conserve water. The Town does not actively encourage water conservation through educational material or distribution or installation of water saving devices. Water saving plumbing fixtures have not been replaced in any municipal buildings.

Leak Detection

Leak Detection Program: *Actively pursued*

Southampton owns its own leak detection equipment. A leak detection program is carried out when there is a suspected problem.

Intermunicipal Connections

Southampton has a relatively small distribution system with only 10 miles of mains greater than 8". The system is primarily located along Rt. 10 and does not extend to the extremities of the town. Southampton abuts 3 municipalities with central water supply systems; Easthampton, Holyoke and Westfield. Southampton maintains a regular connection, with a 6" line, with Holyoke at one of Holyoke's 2 20" lines from the Tighe-Carmody Reservoir. Southampton has a service agreement with Easthampton. Easthampton provides water to a shopping development on the town line. There are 18 road junctions with the 3 towns. The limited nature of Southampton's system limits the number of possible emergency connections. The only potential connection is with Easthampton at the junction along Rt. 10.

Regular Connections:

Existing Service Agreement:	Holyoke - Russellville Road
Existing Service Agreement:	Easthampton - College Highway

Emergency Connections: None

Potential Connections: Easthampton - College Highway

Water Emergencies

Southampton can increase the yield from the College Highway Well in an emergency or connect with the Easthampton water supply via an emergency interconnection. The Hampton well is not a viable short term emergency supply. The Hampton well would require a capital investment for distribution lines and pump before it could be brought on line.

Future Needs

Southampton needs to reconstruct the distribution main that connects the Town to the main Holyoke transmission lines.

SOUTHWICK

Sources of Supply

Southwick developed it's own public water supply is 1978. Prior to this time the Town purchased water from the Springfield Regional Water System. The following sources are used:

Type/Name	Location	Capacity	Safe Yield
Southwick Well #1 (gravel-packed)	Great Brook Aquifer Off Feeding Hills Rd	-	.72 mgd .72mgd

Southwick relies exclusively on Well #1. The safe yield of Well #1 is based on the pumping capacity and the distribution system. The Great Brook Aquifer has potential for future development of additional wells. The Town has long range plans to develop another source but those plans are only in the preliminary stages.

Southwick is still connected to the Springfield Regional System. In 1988 Southwick purchased 30.5mg (17% of the total yearly consumption) from Springfield during high demand periods.

Westfield supplies an estimated 60 services on George Loomis Rd and North Loomis Rd.

Water Demand

1988 Total Water Consumption:	*182.2mg*
1988 Safe Yield:	*.72mgd*
1988 Average Day Demand:	*.5 mgd*
1988 Maximum Day Demand:	*.7 mgd*

Southwick's average daily demand for 1988 was .5 mgd. This figure indicates a small surplus of .01 mgd. However, during periods of peak demand water is purchased from the Springfield Regional System. A deficit is expected to be .12 mgd by the year 2000.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	7,382	3,691	97	0.36	0.80	0.72
1988	8,280	4,140	121	0.50	0.71	0.72
1995	8,518	4,259	121	0.51	0.73	0.72
2000	9,832	4,916	121	0.59	0.84	0.72
2010	11,874	5,937	121	0.72	1.02	0.72

5,971 = Total population which could be served by 1988 safe yield

Pricing Policy

Water Pricing Policy: *Uniform Block Rate*
Water Rate: *$9.34/1000 cu. ft.*

Southwick charges $9.34/1000 cu. ft. through a uniform rate. Ninety five percent of the 1,850 services are metered. The other services are billed at a flat rate. This price structure reflects the full cost of water. An enterprise account has been established.

Southwick is billed a $750 yearly stand-by rate for the right to by water from the Springfield system. Water from the Springfield System is billed at $650/1 million gallons.

Protection Strategies

Water Supply Zoning: *Proposed*
Land Acquisition Strategy: *Not adopted*

Southwick is in the process of developing a water supply protection bylaw to protect the Great Pond and Loomis Brook Aquifer.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

Southwick has not adopted specific zoning regulations to conserve water. Public education brochures on water conservation are available through the Water Department. A water conservation presentation was recently presented in the public schools. Water conserving devices have not been replaced in any municipal buildings

Leak Detection

Leak Detection: *Not actively pursued*

Southwick has not developed a leak detection program but is interested in shared purchase and use of leak detection with neighboring towns.

Intermunicipal Connections

Southwick has 18 miles of main 8" or greater. The distribution system is located primarily along Rt. 10 and in the eastern part of town. Southwick abuts Agawam and Westfield, municipalities with central water supply systems at 12 roadway locations. In addition Westfield's 14" transmission line from the Granville Reservoir to Sackett Reservoir crosses Southwick in the northwest corner of town. Southwick maintains a regular connection with Westfield along George Loomis Road. Several services in that area are provided by Westfield's supply from the main transmission line. Westfield has proposed plans to increase their main Granville transmission line from 14" to 20". The 14" line could then be used to supply an increased number of area residents.

Southwick is also connected to the Springfield Regional System at both North Longyard Road and College Highway. These connections are used to supplement Southwicks supply. In addition to the lines at North Longyard Road and College Highway lines extend to Southwick's town boundaries with Westfield at Tannery Road, with Agawam along Feeding Hills Road and South

Longyard Road. The greatest potential for an interconnection is with Westfield along Tannery Road. At that location Westfield's line extends to the town boundary also.

Regular Connections:		
Service Agreement:	Westfield -	George Loomis Road
Supplemental:	Springfield -	College Highway
		North Longyard Road
Emergency Connections:	None	
Potential Connections:	Westfield -	Tannery Road
	Agawam -	Longyard Road

Water Emergencies

Southwick is able to draw from the Springfield Regional Water Supply System in an emergency.

Future Needs

Southwick needs to develop a new source and tank and install larger lines to improve distribution.

SPRINGFIELD

Sources of Supply

The Springfield Water Department owns and operates the Springfield Regional Water System. Four reservoirs provide a supply of water that more than meets the needs of the member communities of Springfield and Ludlow and the additional communities to whom the system sells water. Currently, only the Cobble Mountain Reservoir in Blandford, Granville and Russell, capacity 22,829,000,000 gallons, and the Ludlow Reservoir, capacity 2,000,000,000 gallons are necessary to provide water to the system. Because of the extraordinary capacity of the Ludlow Reservoir, it is also an emergency source for Springfield. The Borden Brook Reservoir and the Littleville Reservoir with a combined capacity of 5,500,000,000 gallons provide emergency backup supplies.

Type/Name	Location	Capacity	Safe Yield
Cobble Mt. Res.	Granville Blandford	22,829 mg.	55mgd
Borden Brook Res.	Granville	2,200 mg.	
Littleville Dam	Chesterfield	3,300 mg.	30mgd
Ludlow Res.	Ludlow	2,000 mg.	7mgd
			92mgd

Water Demand

1988 Total Water Production:	15,562 mg
1988 Total Consumption, City of Spfld:	11,351 mg
1988 safe yield:	92 mgd
1988 Average Day Demand:	42.6 mgd
1988 Maximum Day Demand:	76.5 mgd

The Springfield Regional Water System serves 100% of the Springfield and Ludlow populations. In addition, the Springfield Water System is the primary supplier of water to the communities of Agawam, East Longmeadow, Longmeadow, and Southwick. Since June, 1989 it has also sold approximately one million gallons per day to the City of Westfield, and sells smaller amounts to Chicopee on a regular basis. It is expected that Springfield will continue to have supplies more than adequate to supply the communities that currently depend upon it. In addition, the MWRA is discussing with Springfield the possibility of the Springfield Regional Water System serving the three western Massachusetts communities of South Hadley, Chicopee and Wilbraham now served by MWRA. While actual water supplies are adequate to do this, the size of transmission lines and existing treatment facilities would have to be increased.

Supply and Demand Summary and Projections[1]

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	152,319	152,319	191	29.02	60.00	92
1988	150,320	150,320	207	31.10	56.00	92
1995	148,571[2]	145,871	207	30.74	55.35	92
2000	150,662	150,662	207	31.17	56.13	92
2010	149,281	149,281	207	30.88	55.61	92

444,696 = Total population which could be served by 1988 safe yield

1 For the City of Springfield only.
2 Based on straight line projection only.

Pricing Policy

Water Pricing Policy: *Uniform Block Rate**
Water Rate: *$10.9/1000cf for first 20,000 cu. ft./quarter*
$3.30/1000 cf over 20,000 cu. ft./quarter

**This rate, while actually a declining block rate, acts as a flat rate for residential users due to the volume of water necessary to move to the lower rate.*

Residents of the City of Springfield and the Town of Ludlow pay the same rates for water, and are currently charged on a flat rate. .

Until July 1, 1989 Agawam, Longmeadow, East Longmeadow, Southwick and Westfield were charged $400 per million gallons of water. As of that date the City of Springfield raised the rate to $655 per million gallons. The rate increase is being protested by the customer communities and negotiations are underway to resolve the problem.

Protection Strategies

Water Supply Zoning: *Not Adopted*
Land Acquisition Strategy: *Adopted*

The City has not adopted any zoning by-laws directed at protecting its water supply. The Department now owns over fourteen thousand acres of watershed land at the Cobble Mountain Reservoir, and over two thousand acres at the Ludlow Reservoir. Both sites are patrolled by Water Department personnel.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*
New State Plumbing Code Enforcement: *Actively enforced*

Public education brochures are mailed to consumers with their bills. While the City has not adopted any specific programs to mandate conservation, it has had some success in encouraging industrial users to recycle water.

Leak Detection

Leak Detection Program: *Actively Pursued*

The Springfield Water Department has an active leak detection and repair program and owns its own leak detection equipment.

Intermunicipal Connections

The Springfield Regional Water System has a complex distribution system. There are over 600 miles of main 8" or greater. Distribution lines pass through 10 municipalities and abut 2 more. Springfield maintains regular connections with Agawam (6 locations), East Longmeadow (4 locations), Longmeadow (1 location), Huntington (1 location), Southwick (2 locations). Emergency connections are maintained with Chicopee (2 locations), Ludlow (1 location), West Springfield (3 locations) and Westfield (3 locations). There are potential emergency connections with Chicopee (2 locations), Huntington (1 location) and Wilbraham (4 locations). Springfield has a surplus of water and is interested in selling water to other water systems. The City is participating in a MWRA study to determine the feasibility of additional sources of supply for the MWRA. The study is being conducted by Tighe-Bond Engineering Company and is expected to be completed by fall, 1990. The MWRA study is expected to provide hydraulic and engineering information required to accurately assess the potential for future interconnections. A description of each interconnection site is provided in the municipal summary of the interconnecting system.

Regular Connections:		
Permanent Long Term:	Agawam -	North Westfield Street
		North Street
		Line Street
		Cooper Street
		Main Street
		Ellison Street
	East Longmeadow -	Harkness Avenue
		White Street
		Cooley Street
		Dwight Street
	Longmeadow -	Magawiska Lane
Existing Service Agreement:	Huntington	
Supplemental Connections:	Southwick -	College Highway
		North Longyard Road

Emergency Connections:		
Permanent Long Term:	West Springfield -	Elm Street Piper Road Rogers Avenue
	Westfield -	Honey Pot Road Shaker Road Southwick
Temporary Short Term:	Chicopee -	East Street North Main Street
Permanent Short Term:	Ludlow -	Shawnigan Drive
Potential Connections:	Chicopee -	Newbury Street St. James Avenue
	Huntington -	Distribution Lane
	Wilbraham -	Miller Street (Ludlow) Boston Post Road Wilbraham Road Tinkham Road

Water Emergencies

Excess capacity in the Ludlow Reservoir and the Borden Brook and Littleville Reservoirs would be used to service the Springfield Water System in an emergency.

Future Needs

The City of Springfield needs to adopt a water conservation program in order to prolong the lifespan & capacity of treatment facilities.

TOLLAND

Sources of Supply

There is no public water supply system in Tolland. The entire population is served by individual on-site wells. There are no known potential sources of public water supply available to Tolland and no plans to develop a public water system.

Water Demand

Not available

Pricing Policy

The full cost of water is assumed by each user.

Protection Strategies

Water Supply Zoning: *Not adopted*
Land Acquisition: *Not Applicable*

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

The town, through its Health Agent, encourages the use of water saving devices in the home.

Leak Detection

Not Applicable

Intermunicipal Connections

Existing: *None*
Potential: *None*

Water Emergencies

There is no strategy to deal with water emergencies.

Future Needs

Tolland does not anticipate any significant change in its water supply needs within the foreseeable future.

WALES

Sources of Supply

There is no public water supply system in Wales. Almost the entire population is served by individual on-site wells. There is one private community well that serves the Lakeside Village Mobile Home Park. There are no known potential sources of public water supply available to Wales and no plans to develop a public water system.

Water Demand

Not available.

Pricing Policy

The full cost of water is assumed by each user.

Protection Strategies

Water Supply Zoning: *Not adopted*
Land Acquisition Strategy: *Not adopted*

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

Leak Detection

Not Applicable

Intermunicipal Connections

Existing: *None*
Potential: *None*

Water Emergencies

There is no strategy to deal with water emergencies.

Future Needs

Generally, groundwater resources have been sufficient to supply the Town's needs, and Wales does not anticipate any significant change in its water supply needs within the foreseeable future. However, it does need to consider a community septic disposal system to serve the Lake George area where a serious potential for well contamination exists.

WARE

Sources of Supply

Ware's public water supply system is owned and operated by the Ware Water Department. It serves approximately 7,700, 80% of the Town's population. The remaining 20% is served by on-site wells. The Ware Water Department uses the following water sources:

Type/Name	Location	Capacity	Safe Yield
Barnes St. Wellfield 4 Wells	Barnes St.,Ware	-	1.24 mgd

Ware is in the final stages of DEP approval for a new well source located off of Rte 32 near the airfield. The preliminary estimated safe yield is .56 mgd. The town recently replaced 2000' of 6" main and 5000' of 12" main to improve its distribution system.

Water Demand

1988 Total Water Consumption: *393 mg*
1988 Safe Yield: *1.24 mgd*
1988 Average Day Demand: *1 mgd*
1988 Maximum Day Demand: *1.6 mgd*

Ware has a small deficit of .36 mgd during periods of maximum daily demand. During periods of extended peak demand, Ware could experience water shortfalls. The new supply should remedy the shortfall. However, ever with the new supply of an estimated safe yield of .56 mgd the surplus will only be .08 mgd by the year 2000.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	8,953	8,416	116	0.97	1.40	1.24
1988	9,630	7,704	140	1.08	1.60	1.24
1995	10,750	8,600	140	1.20	1.79	1.8 [1]
2000	10,292	8,234	140	1.15	1.71	1.8
2010	11,408	9,127	140	1.28	1.90	1.8

8,872 = Total population which could be served by 1988 safe yield

[1] Projected safe yield based on new supply coming on line.

Pricing Policy

Water pricing policy: *Uniform Block Rate*
Water rate: *$12.50/1000 cu ft.*

Ware charges $12.50/1000 cu. ft. though a uniform block rate. The rate structure has changed from a declining block rate. One hundred percent of the 2,450 services are metered.

Protection Strategies

Water Supply Zoning: *Adopted*
Acquisition Strategy: *Adopted*

Ware recently adopted a water supply protection bylaw. Approximately 35 acres have been purchased around the Barnes Wellfield. Another 30 acres have been purchased for the new well.

Conservation Programs/Regulations

Zoning Regulations for water conservation: *Not adopted*

Ware has not adopted specific zoning regulations to conserve water.

Intermunicipal Connections

Ware has 20 miles of mains 8" or greater. The distribution system is concentrated in the center of Town and along Rt. 32. Ware abuts the towns of Belchertown and Palmer (Bondsville) at 8 roadway junctions.
There are no existing regular or emergency connections.
Potential connections with Belchertown are limited because there are no lines in close proximity.
Lines extend from Ware to the town boundary with Palmer in two locations, Rt. 32 and Baron Street. Information was unavailable for Palmer's Bondsville district to fully assess this potential connection.

Regular Connections: None

Emergency Connections: None

Potential Connections: Palmer - Bondsville District - Rt. 32

Water Emergencies

Ware does not have a readily available back-up supply. The development of the new well will allow at least some supply if there should be an equipment failure.

Future Needs:

Ware needs to bring its new supply on line and continue to renovate its distribution system.

WEST SPRINGFIELD

Sources of Supply

West Springfield's public water system serves 100% of the town's population. Prior to 1984, West Springfield supplied 100% of its own water needs from the Bear Hole Reservoir and four wells it owns in the Town of Southwick. The combined safe yield of the wells was 8.75 million gallons per day. However, in 1984 the Southwick well field was closed due to chemical contamination (EDB), and the town began purchasing water from Springfield. Construction of a water treatment plant is planned to restore the Southwick wells.

In 1988 the town of West Springfield pumped 401,222,400 gallons of water from the Bear Hole Reservoir in West Springfield, and purchased 1,252,285,144 gallons of water from the Springfield Regional Water System. The Springfield System has not established an upper limit of the amount of water which can be produced. West Springfield and Springfield have not yet established an agreeable price for that water.

Type/Name	Location	Capacity	Safe Yield
Bear Hole Res.	Western W. Springfield	60mg	1.25 mgd
*Southwick Well #1 gravel-developed	Great Brook Aquifer, Southwick	-----	2 mgd
*Southwick Well #2 gravel-developed	Great Brook Aquifer, Southwick	-----	1 mgd
*Southwick Well #3 gravel-packed	Great Brook Aquifer, Southwick	-----	1.5 mgd
*Southwick Well #4 gravel-developed	Great Brook Aquifer, Southwick	-----	3 mgd

*These wells have been taken off line due to chemical contamination.

Water Demand

1988 Total Water Consumption: *1,653. mg*
1988 Total Safe Yield: *See above*
1988 Average Day Demand: *4.5 mgd*
1988 Maximum Day Demand: *6.1 mgd (estimated from maximum month demand)*

The town has experienced a 20% increase in water demand since 1981, and has an annual water consumption of 1.7 million gallons..

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	27,042	27,042	143	3.87	7.10	6.5
1988	26,798	26,798	169	4.53	6.10[1]	1.25[2]
1995	26,383	26,383	169	4.46	6.01	8.75[3]
2000	28,008	28,008	169	4.73	6.38	8.75
2010	28,812	28,812	169	4.87	6.56	8.75

1 The 1988 MDD is estimated from 1988 maximum month demand.

2 Reflects decrease in supply due to contaminated wells. The Springfield Regional system has not yet established a contractual limit.

3 The projected safe yield based on the resumption of use of the contaminated wells.

Pricing Policy

Water Pricing Policy: *Declining Block Rate*
Water Rate:
0 - 2,000 cu. ft. @ $5.00/1000 cu. ft.
2,000 - 20,000 cu. ft. @ $7.00/1000 cu. ft.
20,000 -100,000 cu. ft. @ $6.50/1000 cu. ft.
over 100,000 cu. ft. @ $5.50/1000 cu. ft.
Water changes are billed semi-annually.

The Board of Selectmen has advocated that municipal water rates reflect all costs associated with water delivery and system maintenance. Enterprise Fund accounting has not been accepted in West Springfield, but "adequate care is taken to separate water related expenses within the Department of Public Works budget" so that costs can be evaluated.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Not adopted*

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

Leak Detection

Leak Detection Program

Intermunicipal Connections

West Springfield has 142 miles of main 8" of greater. The Town abuts Holyoke, Chicopee, Springfield, Agawam and Westfield, which have water supply systems, at 13 roadway sites. The geologic features of the Connecticut River to the east, Westfield River to the south and East Mountain to the west limit the potential for interconnections. Springfield's main supply line from the Provin Mountain Reservoir and Holyoke's main supply line from Tighe Carmody Reservoir both cross through West Springfield.

West Springfield has no regular connections. West Springfield has emergency connections with Springfield in three locations Elm Street, Rogers Avenue and Piper Road. These connections have been used since 1984. There are emergency connections with Holyoke along Riverdale Street and Whitney Avenue. Further connections with Holyoke along their main distribution line are limited by the topography of East Mountain and the lack of West Springfield's lines in that area. A potential connection exists with Agawam at Memorial Drive-Suffield Street. A potential connection exists between Westfield along the Southwick well supply line and Rt. 187.

Regular Connections:	None	
Emergency Connections:		
Permanent Long Term:	Springfield -	Elm Street
		Piper Road
		Rogers Avenue
Temporary Short Term:	Holyoke -	Riverdale Road
		Whitney Avenue
Potential Connections:	Agawam -	Memorial Avenue
	Westfield-	Southwick Well supply line

Future Needs

Development of adequate, clean water supply.

WESTFIELD

Sources of Supply

Until June, 1989, approximately 92% of Westfield's population was served by the City's public water supply system operated by the Westfield Water Department. However, due to the discovery of chemical contamination in wells #3 and 4, the City has been purchasing one million gallons per day from the Springfield Regional Water System. The remaining population is served by individual on-site wells. The Westfield Water Department owns and operates the following water sources:

Type/Name	Location	Capacity	Safe Yield
Well #1 gravel-developed	Holyoke Road, Westfield	N/A	2 mgd
Well #2 gravel-developed	Union Street, Westfield	N/A	2 mgd
*Well #3 gravel-developed	Shaker Road, Westfield	N/A	2 mgd
*Well #4 gravel-developed	Shaker Road, Westfield	N/A	2 mgd
Well #5 gravel-packed	Northwest Road	N/A	.5 mgd
Well #6 gravel-packed	Northwest Road	N/A	.5 mgd
Well #7 gravel-developed	Owen District Road	N/A	2 mgd
Well #8 gravel-developed	Owen District Road	N/A	2 mgd
Granville-Winchell-Sackett Reservoir System	Granville, Southwick Westfield	630 mg	2 mgd

*These wells have been taken off line due to chemical contamination.

The Granville Reservoir System is presently producing a safe yield of two million gallons per day which is limited due to pipeline encrustations. However, with transmission line improvements, the Granville Reservoir system yield could potentially increase to of 3.6 million gallons per day.

Westfield also owns and maintains the Montgomery Reservoir located in the Town of Montgomery which has a safe yield of 1.5 million gallons per day. This reservoir is not presently in use due to water discoloration and high turbidity readings in the fall, but could be reactivated in the future with the addition of a filtration system.

"Westfield's Wells #7 and #8, located on the city's north side, have not yet experienced contamination problems, but are threatened by hazardous materials spills and underground storage tanks located nearby. There is concern about the long-term future of these wells. Wells #3 and #4, located on the city's south side, have been closed since March 1989, when traces of the agricultural pesticide ethylene dibromide (EDB) were found in the well water." (from Barnes Regional Aquifer Protection Final Report and Recommendations, June 1989)

Water Demand

1988 Total Water Consumption: *2,255. mg.*
1988 Safe Yield: *11 mgd.*
1988 Average Day Demand: *6.16mgd.*
1988 Maximum Day Demand: *14 mgd.*

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	36,465	33,548	183	6.13	12.00	15.0
1988	38,650	35,558	174	6.18	14.00	11.0 [1]
1995	39,127	35,997	178	6.42	14.54	11.0
2000	44,602	41,034	178	7.31	16.57	11.0
2010	51,383	47,273	178	8.43	19.09	11.0

61,706 = Total population which could be served by 1988 safe yield

[1] Reflects loss of supply due to contaminated wells.

Pricing Policy

Water Pricing Policy: *Declining Block Rate (business)*
Unmetered Flat Rate (residential)

Water Rate:
for commercial and business users
$9.00/1000 cu ft first 50,000 cubic feet
$7.00/1000 cu ft next 50,000 cubic feet
$5.50/1000 cu ft all additional
for residential users:
$12.50 flat rate and additional billed according to fixtures in residence

The water rates reflect the full cost of water delivery and system maintenance. All water revenues are placed in an Enterprise Account.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Adopted*

The City owns and controls 3,500 acres of watershed land surrounding its Granville Reservoir and 2,000 acres surrounding its Montgomery Reservoir. A caretaker is on duty at both sites daily. When funds become available, the city will apply for an Aquifer Land Acquisition program grant to acquire lands around its wells in the Barnes Aquifer.

The City has adopted a hazardous material control ordinance aimed at protecting the watershed, and monitors all septic tanks within the watersheds at least twice a year.

Westfield along with Southampton, Holyoke, Easthampton, and PVPC, has approved a Memorandum of Agreement for cooperative protection of the Barnes Aquifer, the main water source for these municipalities. This agreement establishes a committee to provide for intermunicipal review of all major development projects within the aquifer area, to coordinate uniform development of land use controls, and to be a forum for future educational or governmental action.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *None*

The City has not enacted any zoning regulations for water conservation, nor does it have any water conservation programs in effect.

Leak Detection

Leak Detection Program: *Not actively pursued*

The city has not developed a leak detection and repair program, nor has it purchased leak detection equipment. At the present time Westfield does not have a capital improvement program to replace a percentage of the water piping system every year.

Intermunicipal Connections

Westfield has 140 miles of mains 8" and over. Westfield abuts the municipalities of Southwick, Russell, Southampton, Holyoke, West Springfield and Agawam, which have central supply systems. There are 19 roadway junctions with there towns. The Holyoke Aqueduct from the Tighe-Carmody Reservoir is located in Westfield. The Springfield Aqueduct from the West Parish filters to Provin Mountain is located in Westfield.

Westfield maintains a regular connection with Southwick along George Loomis Road. Residents in that area of town are served by Westfield from its 14" supply line from the Granville Reservoir.

Westfield maintains three emergency connections with Springfield at Honey Pot Road, Shaker Road and Southwick Road. These are pressure regulated connections from the Springfield Aqueduct.

Potential connections with Southampton are limited because lines do not extend in common areas and Southampton has a small supply source.

There is a potential to connect with Holyoke's main distribution line. Holyoke has a surplus supply. The main limitation to this connection is that the water in those lines is raw, untreated water. Treatment facilities would need to be constructed. A road junction site along Rt. 202 with Holyoke is limited by the topography of East Mountain. West Springfield and Agawam do not have lines in close proximity with Westfield. A potential connection site exists between Southwick at Tannery Road. Lines extend to the municipal boundary from both municipalities.

Regular Connections:		
Service arrangement:	Southwick-	George Loomis Road
Emergency Connections:		
Permanent Long Term Connection:	Springfield -	Honey Pot Road Shaker Road Southwick Road
Potential Connections:	Holyoke -	various locations along the aqueduct
	Southwick-	Tannery Road

Water Emergencies

Westfield maintains three large capacity water storage tanks for emergency supplies. The tanks are at the following locations:

East Mountain	Capacity, 2.75 mg
Norwook	Capacity, 5.00 mg
Northwest Road	Capacity, 1.00 mg

The town plans to add one more tank at the site of the Sackett Reservoir. That tank will have a capacity of 3 mg.

Future Needs

The City's future needs include: construction of a three million gallon storage tank to replace the Sackett Reservoir; repair or replacement of the transmission line from Winchell Reservoir to Sackett Reservoir; construction of a water treatment plant; installation of a water clarification system at the Montgomery Reservoir; improvement of spillways at the Montgomery and Granville Reservoirs; replacement of inadequate transmission lines within the City; and possible new well development. The City has proposed to raise unmetered water rates up to 50 percent to raise funds for the system's necessary capital improvements.

WESTHAMPTON

Sources of Supply

Westhampton does not have a municipal water supply. 52 families, approximately 150 people (about 10% of the towns population) had been served by the privately owned Westhampton Water Company. In early 1990 the Westhampton Water Company will be out of business and all of Westhampton will be served by on-site wells. The water source for the Westhampton Water Company had been the spring-fed Mountain Brook Reservoir off of Montague Rd (.06mgd safe yield).

The main reason cited for the closing is the cost considerations necessary to upgrade the system. Lines needed to be upgraded and a filtration plant needed to be constructed. Preliminary cost estimates indicated it would increase a consumers bill from $104/yr. to a range from $500 - $1,500/yr.

The Town considered purchasing the system from the Westhampton Water Company but again due to cost considerations and inability to reach a satisfactory arrangement with the Water Company decided not to proceed with the purchase.

Thus, there are no immediate plans to install a public water system in Westhampton.

Groundwater supplies have generally proven adequate throughout the town. One family previously supplied by the Water Company reported difficulty drilling an artesian well but was able to dig a shallow well.

Water Demand

1988 Total Water Consumption: *not available*
1988 Safe Yield: *not available*

Pricing Policy (Westhampton Water Company - 1988)

Water Pricing Policy: *Unmetered Flat Rate*
Water Rate: *$104/yr.*

Protection Strategies

Water Supply Zoning: *Proposed*
Land Acquisition Strategy: *Not adopted*

The Westhampton Growth Management Committee has recently developed a water supply protection bylaw which will be presented for Town Meeting approval in Spring 1990. This bylaw will protect the major aquifer areas in town, as well as the watershed area around the Mountain Brook Reservoir and Northampton's Roberts Reservoir complex.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

Westhampton has not adopted specific zoning regulations to conserve water. The town has not replaced plumbing fixtures with water conserving devices in any municipal buildings.

Leak Detection

Leak Detection Program: *Not Applicable*

Intermunicipal Connections

Existing: *Not Applicable*
Potential: *Not Applicable*

Water Emergencies

Water emergencies are handled by individual well owners.

Future Needs

Westhampton believes individual private wells will provide adequate supplies in the future. The town needs to implement it's proposed water protection bylaw.

WILBRAHAM

Sources of Supply

The Wilbraham Water Department supplies approximately 75% of the population with water purchased from the MWRA. The remaining 25% of the residents are supplied by individual, on-site wells.

Water Demand

1988 Total Water Consumption: *416.8mg*
1988 Safe Yield: *N/A*
1988 Average Day Demand: *1.14 mgd*
1988 Maximum Day Demand: *2.4 mgd*

During the year 1988; Wilbraham used 416.8mg of water. It had a maximum day consumption of 2.4 million gallons.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	12,053	8,558	98	0.84	1.75	[1]
1988	12,770	9,578	119	1.14	2.40	
1995	12,774	9,580	119	1.14	2.40	
2000	14,404	10,803	119	1.29	2.71	
2010	16,364	12,273	119	1.46	3.08	

[1] No contractual safe yield limit yet established by MWRA.

Pricing Policy

Water Pricing Policy: *Increasing Block Rate for Residential Use*
Uniform Block Rate for Commercial Use

Water Rate:
Residential
$7.50/1000 cu. ft. 0-10,000 cu. ft.
$10.00/1000 cu. ft. 10,000-20,000 cu. ft.
$12.50/1000 cu. ft. over 20,000 cu. ft.
Commercial
$7.50/1000 cu. ft.

The water rate reflects the full cost of water. Revenue generated from the water rates is deposited in an enterprise account and used to upgrade the water delivery system. (see section on leak detection)

Protection Strategies

Water Supply Zoning: *Adopted*

Wilbraham has adopted a zoning overlay district for protection of groundwater resources.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

Leak Detection

Leak Detection: *Actively pursued*

In 1989 Wilbraham undertook an intensive leak detection effort. Due to the high quality of its infrastructure, only two leaks were discovered. Both have been repaired.

Intermunicipal Connections:

Wilbraham has 72 miles of mains 8" or greater. Wilbraham abuts Monson, Palmer, Springfield and Ludlow which have central supply systems. Wilbraham receives it's supply from the MWRA via the Chicopee Valley Aqueduct along Miller Street through Ludlow to Cottage Street in Wilbraham.

There are no emergency connections. There are no potential connections with Monson or Palmer. Lines from those systems are not in close proximity to Wilbraham's lines. The Chicopee River separates Ludlow from Wilbraham. The Springfield Regional System had maintained an emergency connection with Wilbraham in Ludlow along Miller Street, where the Ludlow Reservoir supply line crosses the Wilbraham supply line. That connection has been removed. There is potential to re-activate that connection. Three other road junction sites offer potential with Springfield: Boston Post Road, Springfield Street-Wilbraham Street and Tinkham Road. At those locations lines extend to municipal boundaries in both municipalities.

Regular Connections:		
Permanent Long Term:	MWRA-	Chicopee Valley Aqueduct
Emergency Connections:	None	
Potential Connections:	Springfield-	Miller Street - Ludlow
		Boston Post Road
		Springfield Street
		Tinkham Road

WILLIAMSBURG

Sources of Supply

The public water system of Williamsburg serves approximately 50% of the Town's estimated 2,600 population. The remaining 50% of the Town's population is served by individual on-site wells. The water system is operated by the Williamsburg Water Department and uses the following sources:

Type/Name	Location	Capacity	Safe Yield
Upper and Lower Unquomonk Reservoirs	Kennedy Rd	10.6mg	1.0mgd
South Street Well (12" gravel packed)	South St.	-	.27mgd
			1.27mgd

The South Street Well is located in an aquifer which is reported to have a large supply. The Town is currently considering another well in that area. The reservoir is the main source of supply during the winter and spring months while the South St. Well is the main source the remainder of the year.

Water Demand

1988 Total Water Consumption: *55.04mg*
1988 Safe Yield: *1.27mgd*
1988 Average Day Demand: *.15mgd*
1988 Maximum Day Demand: *.26mgd*

Williamsburg currently has a surplus of 1.12mgd. The surplus is expected to be 1.1 mgd. in the year 2000.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	2,237	1,119	144	0.16	0.20	1.27
1988	2,400	1,200	126	0.15	0.26	1.27
1995	2,664	1,332	126	0.17	0.29	1.27
2000	2,629	1,315	126	0.17	0.28	1.27
2010	2,956	1,478	126	0.19	0.32	1.27

10,106 = Total population which could be served by 1988 safe yield

Pricing Policy

Water Pricing Policy: *Uniform block rate/unmetered flat rate*
Water Rate: *$7.50/1000 cu ft for metered water*

The flat rate is as follows:
$60/yr for single family residence
$9.00 for each water closet
$6.00 for each bathtub
$15.00 for each sillcock
$50.00 for barns where there are animals

Three hundred and ninety-two of the 500 (78%)services are metered. The metered rate is $7.50/1000cu. ft. The non-metered services are billed at a flat rate based on a yearly charges plus a charge based on the number of fixtures per residence. Future plans are to move towards an all meter policy but no firm timetable has been established. The current price structure reflects the full cost of water delivery. Water revenues are currently placed in a water surplus account. A combined water and sewer enterprise account is in the process of being established.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Adopted*

Williamsburg has adopted a water supply protection bylaw to protect land within the primary and secondary recharge areas of groundwater aquifers and reservoir watershed areas.

Williamsburg has received a $338,000 Aquifer Lands Acquisition grant from the Massachusetts Department of Environmental Protection. The town recently acquired land around the South St. well through this grant.

Williamsburg owns 640 acres around the Unquomonk Brook Reservoir

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

Williamsburg has not adopted specific zoning regulations for water conservation. The Town has not replaced plumbing fixtures with water conserving devices in any municipal buildings. Williamsburg periodically sends water conservation public education brochures with the bills.

Leak Detection

Leak Detection Program: *Not actively pursued*

Williamsburg does not have a leak detection program and does not have immediate plans to begin one. The town is interested in sharing leak detection equipment with other municipalities.

Intermunicipal Connections

Williamsburg has 18 miles of mains greater than 8". The distribution system is concentrated in the village centers of Haydenville and Williamsburg and along Route 9 between the villages. Williamsburg abuts 3 municipalities with central supply systems, Whately, Hatfield and Northampton, at 8 road junction sites. In addition, the main transmission line from Northampton's Mountain Street Reservoir passes through Williamsburg.

There are no existing regular or emergency connections in Williamsburg.

There is one roadway junction with Whately at Mountain Road-Williamsburg Road. Lines do not extend in Williamsburg along this road. There is one roadway junction with Hatfield along Reservoir Road. There are no lines in this area.
There are 5 roadway junctions with Northampton. The junction along Route9 offers the greatest potential for an emergency interconnection. At that location lines from both municipalities extend to the town boundary. Both municipalities have surplus supplies. The main limitations to that site are the small 4" line in Williamsburg and the low pressure (40 lbs.) in Northampton.

A greater potential for an interconnection is a proposed 30" main from the Mountain Street Reservoir to the Leeds Connector. This line would replace the present 12" main and be located along Mountain Street and Rt. 9 in Williamsburg. A permanent emergency connection could be planned for.

Regular Connections: None

Emergency Connections: None

Potential Connections: Northampton - Main Street

Water Emergencies

A verbal agreement exists with Northampton to supply water during an emergency through the Rte. 9 interconnection.

Future Needs

Williamsburg needs to replace and update transmission lines. The chlorinator needs to be updated. A filtration plant for Unquomonk Reservoir needs to be constructed.

WORTHINGTON

Sources of Supply

The public water supply is owned and operated by the private Worthington Fire District. Five hundred thirty of the Town's estimated 1250 (42%) population is served. The remainder of the population is served by individual on-site wells. The following sources are used.

Type/Name	Location	Capacity	Safe Yield
Reservoirs #1 and 2	Ridge Road	1.5mg	.6mgd
Wells 2,3,4 (6" bedrock wells)	Ridge Road	-	.86mgd
Total:			1.46

The main source of supply is the spring fed reservoirs. The wells are only used as backup to the reservoir. An additional source of supply is Well #1 which was recently disconnected from the distribution system. Groundwater resources are generally adequate throughout the town. However, some private wells have reported contamination from sodium (road salt intrusion) and Temik. The Fire District has no plans to pursue other sources.

Engineering studies are underway to correct a distribution problem in the Ringville section of Town.

Water Demand

1988 Total Water Consumption:	*12mg*
1988 Safe Yield:	*1.46mgd*
1988 Average Day Demand:	*.03mgd*
1988 Maximum Day Demand:	*.08mgd*

Worthington currently has a surplus of 1.43mgd. The surplus is expected to be .77mgd by the year 2000.

Supply and Demand Summary and Projections

Year	Population	Population Served	Per Capita Consumption (gpcd)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Safe Yield (mgd)
1980	932	485	78	0.04	0.08	1.46
1988	1,250	525	63	0.03	0.06	1.46
1995	1,581	664	63	0.04	0.08	1.46
2000	1,727 [1]	725	63	0.05	0.08	1.46
2010	1,871	786	63	0.05	0.09	1.46

2,331= Total population which could be served by 1988 safe yield

[1] The year 2000 population projection is based on a straight line method.

Pricing Policy

Water Pricing Policy: *Unmetered flat rate*
Water Rate: *$100/yr for residential use*
$150/yr for commercial use

Worthington Fire District charges $100/yr. for residences and $150/yr. for commercial use through an unmetered flat rate. This price policy currently reflects the full cost of water. A future price increase is being discussed to pay for anticipated improvements to the system. A full metering policy is being discussed but no firm future price policy has been decided.

Protection Strategies

Water Supply Zoning: *Adopted*
Land Acquisition Strategy: *Not adopted*

A Worthington Groundwater Protection Committee worked with the Pioneer Valley Planning Commission to develop a Water Supply Protection District. The Fire District owns 17 acres around the wells and reservoir but does not have a current active acquisition strategy.

Conservation Programs/Regulations

Zoning Regulations for Water Conservation: *Not adopted*

Worthington has not adopted specific zoning regulations to promote water conservation. Water conservation material is made available on the town bulletin board but no formal conservation program is underway.

Leak Detection

Leak Detection Program: *Not actively pursued*

The Fire District has not established a leak detection program but is interested in a shared leak detection program with other towns.

Intermunicipal Connections

Worthington has a small distribution system with most of the lines less than 8" in diameter. The area served is the town center along Rts. 143 and 112. Worthington abuts three other towns with central systems, Cummington, Chester and Huntington with 11 roadway conjunctions. The distribution systems in Worthington and the abutting towns, precludes intermunicipal connections.

Regular Connections: None

Emergency Connections: None

Potential Connections: Limited

Water Emergencies

In an emergency the Fire District can use Wells 2,3,4 to supplement supplies.

Future Needs

Worthington Fire District needs to rebuild/replace the chlorinator and master meter. The Ringville section of town needs a new pressure reducing well to correct a suspected cause of a chloroform problem and improve distribution inadequacies. A filtration plant needs to be constructed.

4.0 EMERGENCY INTERMUNICIPAL WATER CONNECTIONS

4.1 The Need for Interconnections

The provision of a constant, predictable source of high quality water meets basic human needs. The service delivery of water requires that a predictable steady supply in relatively high volumes be constantly transported over large distances through a complex network to a variety of users. It is difficult, if not impossible, to "stock pile" enough water at a location close enough to meet user demand. Any shortfall or disruption in supply can cause health, safety, or economic hardship to the users. Therefore, the primary objective for the establishment of intermunicipal water connections is to prevent disruption of service to users and prevent health, safety or economic hardships. Interconnections can provide a readily available means to transfer water from a municipality with a surplus to a municipality with a shortfall.

The intermunicipal transfer of water can supplement a municipality's water supply when:

- there is an emergency disruption to a service delivery system due to mechanical failure, (i.e. pump failure) or system disruption (i.e. main rupture);
- there is a temporary shortfall of supply due to contamination, pollution, or drought;
- there is excessive demand due to unanticipated emergencies such as a large fire;
- a supply source is inadequate to meet demand.

There can be many causes for a shortfall in water supply. The most common causes are related to service delivery (such as line rupture, pump failure), inadequate supply (due to drought or excessive demand such as for fire protection), or water supply source disruption (from contamination or pollution). A common characteristic of most shortfalls is that they are immediate and unpredictable. There is little advance warning,for instance, of a line rupture. Even drought conditions occur with relatively little advance warning. A primary requirement for the effective use of interconnections is that they be established before they are actually needed.

4.2 Types of Interconnections

Interconnections can be classified into the following categories: Regular Connections, Emergency Connections, and Potential Connections.

There are three types of regular connections:

- Permanent long term connections - connections which exist in municipalities without their own source of supply, an inadequate supply to meet demand, or some type of service agreement (such as an agreement to supply a specified amount of water to a town where another municipality's main reservoir may be located);
- Supplemental connections - connections which provide a supplemental supply to cover regular shortfalls;
- Service agreements - agreements to provide water through a prior service agreement.

The use of regular connections can be an important supply source for municipalities. Many municipalities in the region have established regular connections. This report, however, discusses only emergency and potential connections.

There are three types of emergency connections:

- Permanent long term connections - connections which exist in municipalities which have suffered a serious disruption to supply, such as a contaminated well. Permanent connections have the lines between two systems connected at all times. A shut-off value and meter is established. A pumping station is established, if one is required.

- Permanent short term connections - connections which exist to protect against an unexpected disruption;

- Temporary short term connections - connections which need to be made at the time of each emergency (i.e. fireplug to fireplug). Temporary connections are the connection of a fire hose from one fire plug to another at the town boundary, perhaps pumped with a fire pumper.

Potential connections are those connections which could be made in the future. A variety of factors, detailed in Section 4.1, determine which potential connections could be established as either regular or emergency connections.

4.3 Technical Feasibility of New Connections

There are many Pioneer Valley Communities that could potentially establish additional emergency connections. A difficulty with assessing the feasibility of potential interconnections is the large number of variables involved in the operation of a hydraulic supply system. An engineered hydraulic analysis of systems mechanics and operation is required for each interconnection to accurately determine the system capabilities. There are, however, several relatively simple characteristics of interconnections which can be defined. These fall into two broad categories: technical feasibility and legal/financial issues.

The intermunicipal transfer of water requires physical connections between two systems. In many instances in the study area supply lines do not extend to town boundaries. Where they do extend to the town boundaries the lines are "dead ended" or "looped" back to the same system. In only a few instances in the region are lines from two systems connected with shut-off valves and meters. Thus new emergency connections need to be established.

a. Physical/Locational Aspects of Distribution

The successful establishment of emergency interconnections depends on the following characteristics of the distribution network:

- *Location of Supply Lines* - The best location for emergency interconnections between two systems is where the two systems are the closest. Most often this is where lines extend to town boundaries, or where main supply lines cross neighboring communities.

- *Site Characteristics* - Physical obstructions and other site characteristics at the point of connection must be assessed. For temporary connections, lines on opposite sides of the road may present a hindrance to the connection. In urban areas, lines may be located in the middle of streets, which could preclude the use of portable equipment. Steep slopes at the intersection point could also limit the development or extension of water lines.

- *Line Size* - The line size and available pressure must be large enough to provide a sufficient volume for a supplemental supply. A definite line size is difficult to generalize given the varying demands required by individual systems. In many older systems however it is not unusual for lines as small as 4" to extend to system extremities. Ideally line size should be comparable between the two systems.

- *Line Pressure* - A pressure differential can cause problems at both extremes. A low pressure will not provide adequate volume and could cause a back flow. Low pressure differential can be corrected with a temporary pumping station. High pressure differential can cause leakage problems for a system designed to handle lower pressures.

b. Supply Aspects of Interconnections

The following supply characteristics must also be analyzed to determine if interconnections are feasible:

- *Adequacy of Supply* - There are 3 aspects to consider: total volume produced; surplus above average day demand; and system characteristics. In order for a connection to provide a supplemental supply the volume of water produced by the supplier must be able to have a significant effect on the demand of the receiver. For instance it is not reasonable for a system producing .5 mgd demand to supply a system with a 5 mgd demand. In order for this arrangement to be effective several small supply producers would need to be combined, or one part of the system isolated, and then supplied. An interconnection could still be useful in this instance if the small volume producer were solely the water receiver.

  The establishment of an interconnection should not jeopardize the ability of the supplier community to meet its own demand. For an interconnection to be feasible there needs to be a substantial surplus in the supplier community.

  Another difficulty in determining if one community has an adequate supply to provide an emergency source to another is that distribution systems are not necessarily uniform throughout a municipality. There may be distinct segments in each system. While the overall system may show an adequate surplus, a limitation in one segment of that system, such as high industrial demand or line size limitation, may limit the usefulness of the interconnection.

- *Water Quality Compatibility* - Water supplies in the region are disinfected, pre-chlorinated, fluoridated, treated for taste, coagulation, corrosion, algae-control, and iron, among other treatments. (See table 6.) Each of these treatments requires the introduction of chemicals such as sodium hypochloride, soda ash, copper sulfate, hydrofluosilicic acid, chlorine gas, chlorine, sodium fluoride, and polymers into the water supplies. While most of the time these different chemicals are compatible, there may be instances where a chemical reaction could occur which could affect water taste, color, or appearance.

  Another water quality characteristic to be considered when connecting with main truck lines is the location of the treatment facilities. Many main trunk lines carry untreated, "raw" water and an interconnection to this supply would require portable treatment facilities.

  A third water quality issue is the fluoridation vs. non-fluoridation issue. Many municipalities in the region are fluoridating water supplies to help prevent tooth decay. Many other municipalities have actively opposed fluoridation, making interconnection incompatible.

  Biofilm build up and release of biofilm with reverse flow can also present a problem. Minute amounts of biofilm build up along the inside walls of supply lines. A flow reversal can dislodge this biofilm. Increased flushing and supplemental treatment can reduce this problem.

Table 6. WATER TREATMENT - 1988

Water Supply	Types of Treatment	Treatment Chemicals
Agawam	*	*
Amherst	Coagulation, Sedimentation, Filtration, Corrosion, Fluoridation, Disinfection	*
Belchertown	Corrosion	*
Blandford	Prechlorination, Softening	Sodium hypochloride, Dense soda ash
Chester	*	
Chicopee	Disinfection	Chlorine gas
Cummington	*	
Cummington Center	*	
West Cummington	*	
East Longmeadow	*	
Easthampton	*	
Granby	(see S.H. FD#2)	
Granville	*	
Hadley	*	
Hatfield	Sedimentation, Taste, Disinfection	Copper sulfate, Sodium hypochlorite
Holyoke	Fluoridation, Disinfection	Hydro fluosilicic acid, Chlorine gas, Copper sulfate
Huntington	Prechlorination,	12.5% Chlorine, Sodium hypochlorite
Longmeadow	Fluoridation, Chlorination	Sodium fluoride, Sodium hypochlorite
Ludlow	Aeration, Filtration	Chlorine gas
Monson	*	
Northampton	Disinfection	Liquid chlorine gas
Palmer		
F.D#1	Corrosion, Disinfection	
Thorndike	*	
Three Rivers	Corrosion, Disinfection	
Bondsville	*	

Water Supply	Types of Treatment	Treatment Chemicals
Pelham	(see Amherst)	
Russell	Prechlorination, Coagulation Sedimentation, Filtration, Iron, Disinfection	12% Sodium hypochlorite
South Hadley FD#1 FD#2	Disinfection Filtration, Other Post Chlorination	Chlorine gas 100%
Southampton	Disinfection	Sodium hypochlorite 12%
Southwick	*	
Springfield	Prechlorination, Coagulation Filtration, Corrosion, Disinfection	Chlorine gas, Polymer (magna floc. 372C) sodium hydroxide, chlorine
Ware	Corrosion	Sodium hydroxide
West Springfield	Aeration, Filtration, Disinfection Algae Control	Liquid chlorine, Copper sulfate
Westfield	Aeration, Corrosion, Disinfection	Calgon TG10, Chlorine, Aqualite-soda ash
Westhampton	Disinfection	12.5% Sodium hypochlorite
Wilbraham	*	
Williamsburg	Disinfection	12.5% Du-well hypochlorite
Worthington	Disinfection	NAOCL 12%

* Data Unavailable
(from D.E.P Community Public Water Supply Statistics - 1988)

4.4 Legal/Financial Issues for New Emergency Connections

a. Financial Issues for New Emergency Connections

There are three major financial issues a water supply system must consider for new emergency connections: construction or "hookup" costs; operating costs; and costs for the purchase of water, if any.

Costs will vary greatly depending on the type of connection to be developed. Generally the more permanent the connection the greater the initial cost. The unique nature of each connection makes it difficult to specify the exact costs which would be incurred. It is, however, possible to give estimated cost ranges:

Equipment /Installation Costs

Permanent connections may require engineering feasibility studies to determine an analysis of system hydraulics and the feasibility of adequate supply delivery. Costs will be incurred for the purchase of new material such as mains, shutoffs, and meters. A pumping station, if needed, would increase costs. An estimated cost for construction of meter pit for an 8" line with shut-off and by-pass is approximately $20,000. With a larger size line that cost could increase to $40,000 to $50,000. A portable pump with a capacity of 300,000 gallons/day costs between $20,000 to $30,000.

Installation costs will also be incurred. These costs depend on the size and length of line to be installed and the physical terrain to be covered. Generally installing line a short distance over a relatively flat terrain is the least expensive. However, in a highly urbanized area other obstacles may be encountered, such as interference from other infrastructure, which could increase costs. The installation of line typically costs in the range of $100 - $150/linear ft.

There are few initial connection costs for temporary emergency connections, such as fireplug to fireplug. Standard fire line or irrigation line is sufficient for these connections in most instances. An existing fire pump may be able to be used if a portable pump is required. In rare instances a portable chlorinator may be required to treat untreated water from a main distribution supply line. A portable chlorinator costs in the range of $5,000 - $7,000.

Operating Costs

Operating costs will be incurred by both the supplier and receiver municipalities. The supplier community will have increased costs in direct relation to meeting increased demand as a result of the interconnection. These will include costs of operating pumping facilities, costs for water treatment, and personnel. These costs will be directly related to the length of time the interconnection is in use. Operating costs incurred by the receiver municipality will be limited to additional hours for personnel which might be required to monitor or maintain the connection. Operating costs will be relatively insignificant when weighed against the benefit of steady delivery of water.

Payment of Costs

Typically, municipalities have provided mutual aid to one another during emergencies. This commonly occurs now with fire protection support. It is the predominant manner in which emergency interconnections are handled in the region now.

However, for the establishment of new emergency interconnections the following issues must be considered:

- Who pays the construction costs of the connection?
- Is there going to be a charge for the water consumed?
- What should that charge be?

The issue of who pays for the construction of the connection primarily depends on who benefits the most from the interconnection. In instances of reciprocal transfer of water both communities have shared the construction costs of the connection. In the case where only one community is likely to be the primary receiver of water it is reasonable for that community to assume all, or the greatest share of the costs. Costs are likely to be lower if the installation of an intermunicipal connection is undertaken during the upgrading or improvement of a system. For instance, extending the line to the town boundary when a section of line is replaced is likely to be less expensive than specifically installing a small section of line. Therefore it is important that capital planning consider future interconnections when improvements to a system are needed.

There are two types of charges typically assessed regarding water consumed via interconnections: an annual "hook-up" fee and a per unit charge for the amount of water consumed. When an agreement is reciprocal, typically no annual charge is assessed since both parties benefit mutually from the connection. A per unit charge is assessed only if one party receives a substantially greater amount of water over a period of time. In essence this arrangement could be considered a water "trade". Where one party only is a water receiver, an annual charge is assessed for the right of the interconnection. A per unit cost for water used is then charged based upon a wholesale rate for water by the supplier municipality. For instance, Southwick pays the Springfield system $750/year for an interconnection and $650/mg for any water it uses to supplement its system.

b. Legal Issues for New Emergency Connections

Municipalities get their authority to enter into agreements for emergency water connections from two sources. Chapter 40, section 4A of the Massachusetts General Laws authorizes intergovernmental agreements with town meeting or city council approval by majority vote. Chapter 40, section 40 gives municipalities the right to purchase water from other communities or water districts during emergencies.

Agreements or contracts entered into by communities seeking to provide and/or receive water from another municipality in times of emergency should anticipate the types of decisions that will have to be made under adverse conditions by including clear definitions and operational procedures. At a minimum, each agreement should contain the following:

- *Purpose Statement* - The intent of the agreement should be stated clearly to avoid confusion at a later date. Such a statement can be very simple and straightforward: "This agreement is entered into for the purpose of providing potable water to the municipality(ies) of _____ when an emergency condition related to the quantity or quality of water available exists."

- *Emergency Criteria* - Since a bona fide emergency is the trigger to activate an intermunicipal connection, a clear statement of what constitutes an emergency or how a condition of emergency shall be agreed upon needs to be a part of every

contract. This section of the contract should state that any such emergency shall be approved by both communities. Emergency criteria can include language concerning water pressure, yield requirements, and/or specific events such as fire, contamination/pollution, and drought. This section should also contain language on how the end of an emergency period is determined.

- *Activation Procedure* - This part of the contract should establish a clear procedure for activating the water connection. It should specifically state which community actually turns the water on, who should be notified, and what, if any, are the monitoring procedures beyond the water meter itself.

- *Reciprocity Statement* - The contract should state whether communities will receive water from each other during times of emergency or whether only one community will act as the supplier.

- *Standard Terms* - Like all contracts and agreements, those for emergency connections should include starting and ending dates, and renewal and termination procedures as well as an escape clause.

- *Measurement of Water Use* - Metering devices for each town should be in place at the point of intermunicipal connection, and the agreement should establish a regular program for meter reading.

- *Limit Statement* - The supplier municipality's water system must be capable of supplying to its own customers the maximum amount of water that will be used at any given time. Therefore, each contract should contain a statement of the maximum amount of water that can be transferred. This limit should be based on the maximum needs of the supplier community and the safe yield of its water supply system, as well as on the needs of the receiver community.

- *Cost of Water* - The cost of water should be consistent with the supplier's cost of water delivery. The agreement should state how the price will be set, billing periods and any agreements for the return of a like amount of water in lieu of cash payment.

- *Cost of Equipment* - There are two kinds of equipment costs related to intermunicipal connections: initial installation and maintenance. In reciprocal agreements, where each municipality expects to both receive and deliver water at one time or another, communities generally share installation and maintenance costs of the connection and maintain their own systems up to the point of connection. Where only one community expects to receive water, it is more likely that the receiving community will install and maintain the connection. In addition, a receiver community may agree to pay for limited improvements to the supplier community's distribution system. For example, if it is found that in the supplier community the water main to the connection point will not deliver the amount of water required, the receiving community may pay for an increase in pipe size.

- *Conservation Requirement* - Specific conservation measures should be defined for the receiver municipality during the period when it is receiving emergency water. These measures should reflect, as a minimum, conservation restrictions applicable to residents of the supplier community, and emergency requirements of the Department of Environmental Protection.

- *Disclaimer of Responsibility* - While not likely, it is possible that damages could occur related to mixing treated water supplies, pressure inequalities or other unforeseen problems that arise when combining water from two different systems. Therefore, any intermunicipal agreement should include a statement wherein each municipality releases the other from any claims for damages.

4.5 Inventory of Potential Emergency Intermunicipal Water Connections

a. Existing Interconnections

Water supply systems in fifteen municipalities in the Pioneer Valley Region have regular water connections with other municipalities or systems at 23 connection sites. These connections serve as the primary or supplemental source of water for the receiving municipalities. The two largest suppliers are the Springfield Regional Water system and the MWRA. The Springfield system serves five municipalities: Huntington (for fire protection only), Southwick, Agawam, Longmeadow, and East Longmeadow. The MWRA serves Wilbraham, Chicopee, and South Hadley FD #1. Table 7 lists the regular water supply connections.

Emergency connections exist in 25 locations in 15 municipalities. These range from temporary short term "fire plug to fire plug" connections to permanently established connections. There is only one intermunicipal agreement to cover these connections, between Northampton and Easthampton. (Contracts do exist between the Springfield system and the municipalities it supplies.) Table 8 lists emergency connections.

b. Case Examples of Interconnections

The closing of West Springfield's wells shows the importance of emergency interconnections. In 1984 West Springfield was ordered by the Department of Environmental Protection to close its Southwick wells due to EDB contamination. This closure resulted in a 67% loss of West Springfield's supply. However, through emergency interconnections with Springfield, West Springfield was, and still is, able to meet the needs of its residents with little disruption.

A more recent use of a temporary emergency connection occurred in Hatfield in May 1990. The Town suffered a break in an old 6" main in a remote, inaccessible section of town. More than 1 million gallons leaked before the leak could be repaired. Eight hundred gallons of water per minute were pumped through interconnections with Whately and Northampton to maintain pressure to Hatfield's system. In this instance water was transferred to Whately by its neighboring town, Deerfield, to maintain Whately's supply.

c. Potential New Interconnections

The potential exists for further emergency connections. Twenty-five additional connection sites, in 20 municipalities in the region were identified with the potential to become emergency connections.

Sites were evaluated using the criteria established in section 4.1. Data sources included the Connecticut River Valley Pesticide Study produced by Stone and Webster Engineering Corp. for the Massachusetts Department of Environmental Protection, distribution maps of water systems, topographic maps, and conversations with local water officials. Table 9 contains an inventory of potential connection sites. A more

complete site description and further analysis of the potential for municipalities to establish interconnections is located in the town-by-town municipal summaries. Specific actions that water systems could take to enhance emergency intermunicipal is listed in section 10.4.

The next step for water systems to take is to further assess the potential for these sites. A major study commissioned by the MWRA to assess the feasibility of Springfield and/or Holyoke becoming a supplemental supply source is currently underway. One component of that study is an analysis of potential interconnections. When completed that study could provide useful information for the region's municipalities.

Intermunicipal Water Supply Connections

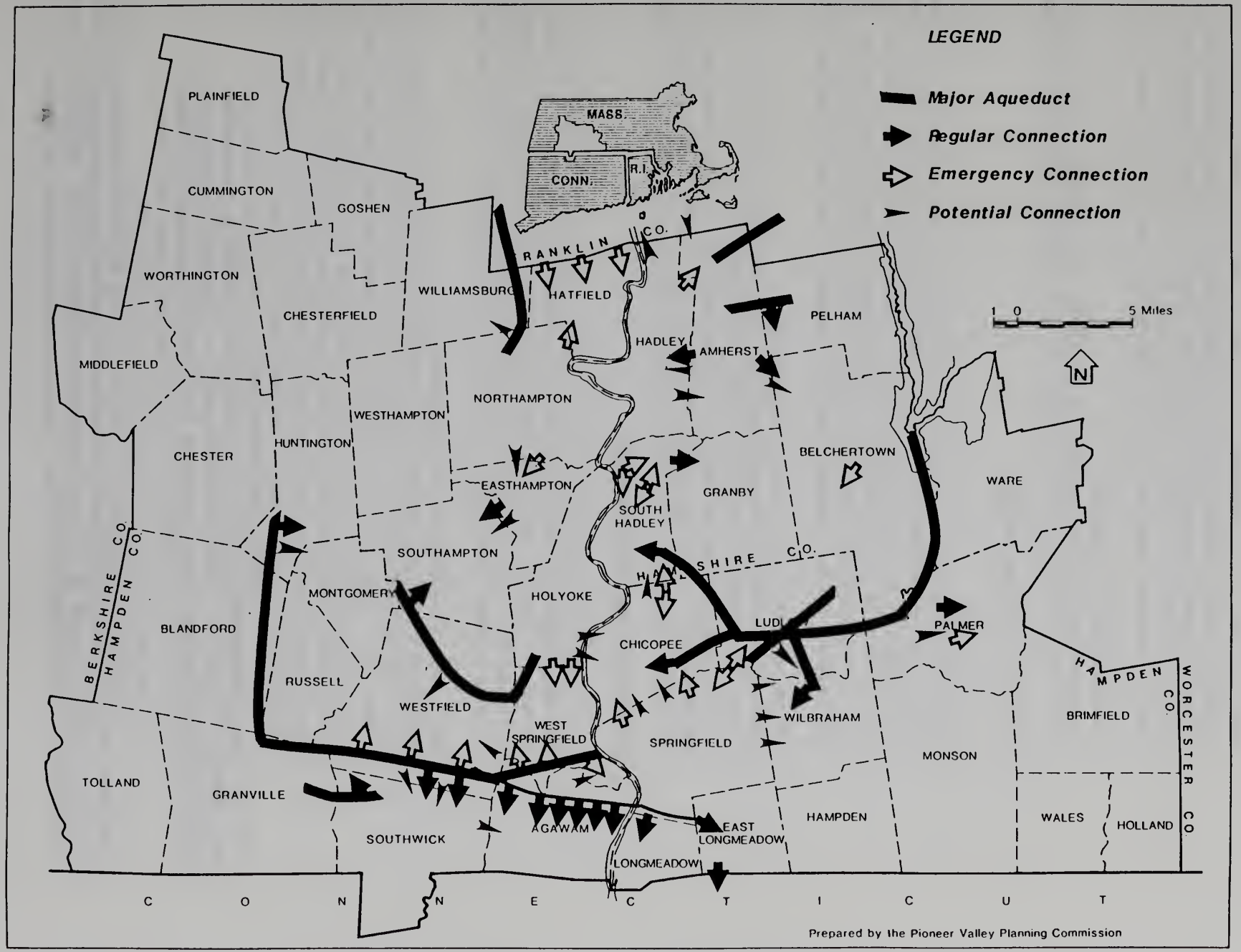


Table 7. EXISTING REGULAR INTERMUNICIPAL WATER SUPPLY CONNECTIONS

Primary Water Supply (P)	Secondary Water Supply (S)	Connector Location (P)	Connector Location (S)	Connector Size (index) (P)	Connector Size (index) (S)	Pressure (lbs) (P)	Pressure (lbs) (S)	Type
Agawam	Springfield	N. Westfield Street	Springfield Aqueduct	8	42	75	N/A	Permanent long term
		North Street	Springfield Aqueduct	6	54	75	N/A	Permanent long term
		Line Street	Springfield Aqueduct	6	54	100	N/A	Permanent long term
		Cooper Street	Springfield Aqueduct	6	48	100	N/A	Permanent long term
		Main Street	Springfield Aqueduct	8	48	130	N/A	Permanent long term
		Ellison Avenue	Springfield Aqueduct	8	48	135	N/A	Permanent long term
Amherst	Pelham	Stoney Hill Road	Harkness Avenue		12	12		Existing service agreement
		Pelham Road	Amherst Road		12	12		Existing service agreement
	Belchertown	Belchertown Rd.	Amherst Road	12	8			Existing service agreement
	Hadley	Northampton Rd.	Russell Street	8	8			Existing service agreement
Belchertown	Amherst	Amherst Road	Belchertown Road	8	12			Existing service agreement
Blandford	None	-	-	-	-	-	-	-
Chester	None	-	-	-	-	-	-	-
Chicopee	MWRA	Fuller Street	Chicopee Valley Aqueduct		24	36		Permanent long term
Cummington								
Cummington Center	None	-	-	-	-	-	-	-
W. Cummington	None	-	-	-	-	-	-	-
E. Longmeadow	Springfield	Harkness Avenue	Harkness Avenue	24	16			Permanent long term
		North Main Street	White Street	12	12	30		Permanent long term
		Elm Street	Cooley Street	8	8	30		Permanent long term
	via Longmeadow	Chestnut Street	Dwight Street	8	12	30		Permanent long term
	Enfield, Conn.	Shaker Road						Permanent long term
Easthampton	Southampton	Main Street	College Highway	8		-	-	Existing service agreement
Granby	South Hadley FD #1	Off Ludlow Road		12				Existing service agreement
	South Hadley FD #2	Amherst Road		6	10			Existing service agreement
Granville	None	-	-	-	-	-	-	-
Hadley	Amherst	Russell Street	Northampton Road	8	8			Existing service agreement

Primary Water Supply (P)	Secondary Water Supply (S)	Connector Location (P)	Connector Location (S)	Connector Size (index) (P)	Connector Size (index) (S)	Pressure (lbs) (P)	Pressure (lbs) (S)	Type
Hatfield	None	-	-	-	-	-	-	-
Holyoke	Southampton	Off Russellville Rd.		6	26			Existing service agreement
Huntington	Springfield	Off Littleville Rd.			48			Existing service agreement
Longmeadow	Springfield	Forest Glen Road	Magawiska Lane	16	16	100		Permanent long term
Ludlow	None	-	-	-	-	-	-	-
Monson	None	-	-	-	-	-	-	-
Northampton	None	-	-	-	-	-	-	-
Palmer								
District #1								
Throndike	Palmer-Bondsville	Pleasant Street		6		70	70	Permanent long term
Bondsville	Palmer-Throndike	Pleasant Street			6	70	70	Permanent long term
Three Rivers	None	-	-	-	-	-	-	-
Pelham	Amherst	Harkness Avenue	Stoney Hill Road	12	12			Existing service agreement
		Amherst Road	Pelham Road	12	12			Existing service agreement
Russell	None	-	-	-	-	-	-	-
South Hadley								
District #1	MWRA	Off New Ludlow Rd.			12			Permanent long term
	Granby	New Ludlow Rd.						Existing service agreement
District #2	Granby	Route 116		10	6			Existing service agreement
Southampton	Holyoke	Off Russellville Rd.		6	20			Existing service agreement
	Easthampton	College Highway	Main Street		8			Existing service agreement
Southwick	Westfield	George Loomis Rd.			14			Existing service agreement
	Springfield	College Highway		10	6	75		Supplemental
	Springfield	North Longyard Rd.		10	10	90		Supplemental
Springfield	Agawam	Spfld. Aqueduct	N. Westfield St.	42	8		75	Permanent long term
		Spfld. Aqueduct	North Street	54	6		75	Permanent long term
		Spfld. Aqueduct	Line Street	54	6		100	Permanent long term
		Spfld. Aqueduct	Cooper Street	48	6		100	Permanent long term
		Spfld. Aqueduct	Main Street	48	8		130	Permanent long term
		Spfld. Aqueduct	Ellison Avenue	48	8		135	Permanent long term

Primary Water Supply (P)	Secondary Water Supply (S)	Connector Location (P)	Connector Location (S)	Connector Size (index) (P)	Connector Size (index) (S)	Pressure (lbs) (P)	Pressure (lbs) (S)	Type
	East Longmeadow	Harkness Avenue		16	24			Permanent long term
		White Street	N. Main St.	12	12		30	Permanent long term
		Cooley Street	Elm Street	8	8		30	Permanent long term
		Dwight Street	Chestnut Street	12	8		30	Permanent long term
	Huntington	Off Littleville Rd.		48				Existing service agreement
	Longmeadow	Magawiska Lane	Forest Glen Road	16	16		100	Permanent long term
	Southwick	College Highway		6	100		75	Supplemental
		N. Longyard Rd.		10	10		90	Supplemental
Ware	None	-	-	-	-	-	-	-
West Springfield	None	-	-	-	-	-	-	-
Westfield	Southwick	George Loumis Rd.		14				Existing service agreement
Wilbraham	MWRA-Chicopee	Valley Aqueduct			20			Permanent long term
Williamsburg	None	-	-	-	-	-	-	-
Worthington	None	-	-	-	-	-	-	-

Table 8. Existing Emergency Intermunicipal Water Supply Connections

Primary Water Supply (P)	Secondary Water Supply (S)	Connector (P)	Location (S)	Connector Site (inches) (P)	(S)	Pressure (lbs) (P)	(S)	1988 Surplus/ Deficit (mgd) (P)	(S)	Written Agreement Between Systems	Type
Agawam	None										
Amherst	Hadley	Meadow Rd.	Roosevelt St.	8	8	100	90	-.2	2.3	No	Temporary Short Term
Belchertown	Belchertown St. School	S. Main St.		6	12	85		.11			Temporary Short Term
Blandford	None							.35			
Chester	None							.19			
Chicopee	S.H. FD #1	New Ludlow Rd.		12	16	80		-	1.5	No	Temporary Short Term
	Springfield	East St.		16	12	65		-	49.4	No	Temporary Short Term
	Springfield	Center St.	N. Main St.	17	12			-	49.4	No	Temporary Short Term
Cummington											
Cummington Ctr.	None										
W. Cummington	None										
East Longmeadow	None										
Easthampton	Northampton	Northampton St.	Easthampton Rd.	12	12	100		1.6	5.4	Yes	Temporary Short Term
Granby	None	-	-	-	-	-			-	-	
Granville	None	-	-	-	-	-			-	-	
Hadley	Amherst	Roosevelt St.	Meadow Rd.	8	8	90	100	2.3	-.2	No	Temporary Short Term
Hatfield	Northampton	West St.	King St.	6	8			.43	5.4	No	Temporary Short Term
	Whately	West St.	West St.	4	8	70	70	.43		No	Temporary Short Term
		Straits Rd.	Long Plain Rd.	8	8	70	70	.43		No	Temporary Short Term
		River Rd.	River Rd.	4	8	70	70	.43		No	Temporary Short Term
Holyoke	W. Springfield	Riverdale Rd.		8	10	100	115	7.	-3.25	No	Temporary Short Term
		Whitney Ave.		12	6		70	7.	-3.25	No	Temporary Short Term

Primary Water Supply (P)	Secondary Water Supply (S)	Connector (P)	Location (S)	Connector Site (inches) (P)	(S)	Pressure (lbs) (P)	(S)	1988 Surplus/ Deficit (mgd) (P)	(S)	Written Agreement Between Systems	Type
Huntington	None										
Ludlow	Springfield	Shawinigan Dr.						5	49.4	No	
Monson	None										
Northampton	Hatfield	King St.	West St.	8	6			5.4	.43	No	Temporary Short Term
	Easthampton	Easthampton Rd.	Northampton St.	12	12		100	5.4	1.6	Yes	Temporary Short Term
Palmer											
District #1											
Thorndike	Palmer-Three Rivers	Main St.		8	6	70	70	-	.54		
Bondsville											
Three Rivers	Palmer-Thorndike	Main St.		6	8	70	70	.54	-		
Russell	None										
South Hadley											
District #1	S.H. FD #2	College St.		12	8	100	90	1.5	.65	No	Temporary Short Term
		Ferry St.		12	8		90	1.5	.65	No	Temporary Short Term
		East St.		8	8	80	90	1.5	.65	No	Temporary Short Term
		Parkview Dr.		8	6		90	1.5	.65	No	Temporary Short Term
		Cypress Dr.		8	6		90	1.5	.65	No	Temporary Short Term
	Chicopee	New Ludlow Rd.		16	12		80	1.5	.65	No	Temporary Short Term
District #2	S.H. FD #1	College St.		8	12	90	100	.65	1.5	No	Temporary Short Term
		Ferry St.		8	12	90		.65	1.5	No	Temporary Short Term
		East St.		8	8	90	80	.65	1.5	No	Temporary Short Term
		Parkview Dr.		6	8	90		.65	1.5	No	Temporary Short Term
		Cypress Dr.		6	8	90		.65	1.5	No	Temporary Short Term
Southampton	None										
Southwick	None										

Primary Water Supply (P)	Secondary Water Supply (S)	Connector (P)	Location (S)	Connector Site (inches) (P)	(S)	Pressure (lbs) (P)	(S)	1988 Surplus/ Deficit (mgd) (P)	(S)	Written Agreement Between Systems	Type
Springfield	Chicopee	East St.		12	16		65	49.4	-	No	Temporary Short Term
		N. Main St.		12	12			49.4		No	Temporary Short Term
	Ludlow	Shawinigan Dr..						49.4	5.0		
	W. Springfield		Elm Street		8		90	49.4	-3.25	Yes	Permanent Long Term
			Piper Rd.		10		95	49.4	-3.25	Yes	Permanent Long Term
			Rogers Ave.		10		95	49.4	-3.25	Yes	Permanent Long Term
	Westfield		Honey Pot Rd.		6		50	49.4	-3.0	Yes	Permanent Long Term
			Shaker Rd.		6		100	49.4	-3.0	Yes	Permanent Long Term
			Southwick rd.		6		50	49.4	-3.0	Yes	Permanent Long Term
Ware	None										
West Springfield	Springfield	Elm St.		8		90		-3.25		Yes	Permanent Long Term
		Piper Rd.		10		93		-3.25		Yes	Permanent Long Term
		Rogers Ave.		10		35		-3.25		Yes	Permanent Long Term
	Holyoke	Riverdale Rd.		10	8	115	100	-3.25	7.	No	Temporary Short Term
		Whitney Ave.		6	12	20		-3.25	7.	No	Temporary Short Term
Westfield	Springfield	Honey Pot Rd.		6		50		-3.0	49.4	Yes	Permanent Long Term
		Shaker Rd.		6		100		3.0	49.4	Yes	Permanent Long Term
		Southwick rd.		6		50		3.0	49.4	Yes	Permanent Long Term
Wilbraham	None										
Williamsburg	None										
Worthington	None										

Data Sources: Connecticut River Valley Pesticide Study for MDEP by Stone and Webster Eng. Corp., 1988
PVPC Municipal Water Supply Survey - 1989
MDEP Community Public Water Supply Statistics
PVPC Water 2000 - 1987
Phone conversations with local municipal water officials

Table 9. Potential Emergency Intermunicipal Water Supply Connections

Primary Water Supply (P)	Secondary Water Supply (S)	Connector (P)	Location (S)	Connector Site (Inches) (Closest Available Line) (P)	(S)	Connector Pressure (lbs) (Closest Available Line) (P)	(S)	Site Elevation (Ft. Above Sealevel)	Lines Extend to Town Boundary (P)	(S)	Adequacy of Supply (mgd) (P)	(S)
Agawam	West Springfield	Suffield St.	Memorial Av.	12				50	Y	Y	-	-3.25
	Southwick	Barry St.	Longyard Rd.	8	8			230	N	Y	-	.01
Amherst	Hadley	N'hampton Rd.	Russell St.	8	8			150	Y	Y	- .2	2.2
		West Bay Rd.	Bay Rd.	12	8			250	Y	N		
	Sunderland	Route 116		8	8			160	N	Y		
	Belchertown	Route 9		12				350	N/A	N	-.2	.11
Belchertown	Amherst	Old Federal St.	N/A	8				350	N	N/A	.11	-.2
Blandford	Limited								-	-	.35	
Chester	Limited								-	-	.08	
Chicopee	Springfield	Newbury St.			12			215	Y	Y	-	49.4
		St. James Av.			12				Y	Y	-	
	Holyoke	Willimansett Bridge			16 (proposed)			70	N	(proposed)	-	7
	S.H.F.D. #1	Montcalm St.			16 (proposed)			240	Y	Y	-	1.5
Cummington	Limited										-	
East Longmeadow	Limited										-	
Easthampton	Northampton	Florence Rd.		6	6	90	50	260	Y	Y	1.6	5.4
	Southampton	Main St.	College Highway	6		70		180	Y		1.6	.42
Granby	Limited										-	-
Hadley	Amherst	Russell St.	Northampton Rd.	8	8			150	N/A	Y	2.2	-.2
		Bay Road	W. Bay Road	8	12			250	N	Y		
	Sunderland	River Drive	River Road	8	12			130	Y	Y	2.2	

Primary Water Supply (P)	Secondary Water Supply (S)	Connector (P)	Location (S)	Connector Site (Inches) (Closest Available Line) (P)	(S)	Connector Pressure (lbs) (Closest Available Line) (P)	(S)	Site Elevation (Ft. Above Sealevel)	Lines Extend to Town Boundary (P)	(S)	Adequacy of Supply (mgd) (P)	(S)
Hatfield	Limited										4.3	
Holyoke	Westfield	Distribution line		N/A	20				N/A	N/A	7	-3.0
	S. Hadley FD #1	Rt. 116 Bridge		16 (proposed)				50	proposed	N	7	1.5
	Chicopee	Willimansett		16 (proposed)				70	proposed	N	7	-
Huntington	Springfield	Distribution line			48			450	Y	N/A	.32	49.4
Longmeadow	Limited											
Ludlow	MWRA	Miller St.		30	20			230	N/A	N/A	7	
Monson	Palmer FD #1	State Ave.		6		175		320	Y		1.05	-.1
Northampton	Easthampton	Florence Rd.		6	6	50	90	260	Y	Y	5.4	1.6
	Williamsburg	Haydenville Road	Main St.	30 (proposed)	N/A				Y	Y	5.4	1.1
Palmer District #1 Thorndike Bondsville Three Rivers	Data not available											
Russell	Limited										.13	
South Hadley District #1	Holyoke	Rt. 116 Br.			16 (proposed)			50	N	pro-posed	1.5	7
	Chicopee	Montcalm St.						240	Y	Y	1.5	
District #2	Limited								-	-	.65	
Southampton	Easthampton	College Highway	Main St.	6				180	Y		.42	1.6

Primary Water Supply (P)	Secondary Water Supply (S)	Connector (P)	Location (S)	Connector Site (Inches) (Closest Available Line) (P)	(S)	Connector Pressure (lbs) (Closest Available Line) (P)	(S)	Site Elevation (Ft. Above Sealevel)	Lines Extend to Town Boundary (P)	(S)	Adequacy of Supply (mgd) (P)	(S)
Southwick	Westfield	Tannery rd.		8	12			180	Y	Y	.01	-3.0
	Agawam	Longyard Rd.	Barry St.	8	8			230	Y	N	.01	-
Springfield	Chicopee	Newbury St.		12				215	Y	Y	49.4	
		St. James Av.		12					Y	Y		
	Huntington	Distribution line						450	N/A	Y	49.4	.32
	Wilbraham	Miller St. (Ludlow)		30	20			230	N/A		49.4	
		Boston Post Rd.	8					240	Y	Y		
		Wilbraham Rd.	Springfield St.	8				230	Y	Y		
		Tinkham Road		12				255	Y	Y		
Ware	Palmer-Bondsville								Y		-.36	.15
W. Springfield	Agawam	Memorial Av.	Suffield St.		12			50	Y	Y	-3.25	-
	Westfield	Southwick Well Supply Line						N/A	N/A	-3.25	-3.0	
Westfield	Holyoke	Distribution line	(42 proposed)	20					N/A	N/A	-3.0	7
	Southwick	Tannery Rd.		12	8			180	Y	Y	-3.0	.01
Wilbraham	Springfield (Ludlow)	Miller St.		20	30			230	N/A	N/A	-	49.4
		Boston Post Rd.		8				240	Y	Y		
		Springfield Street	Wilbraham Rd.		8			230	Y	Y		
		Tinkham Rd.			12			255	Y	Y		
Williamsburg	Northampton	Main St.	Haydenville Rd.	30 (proposed)					Y	Y	1.12	5.4
Worthington	Limited										1.43	-

5.0 MUNICIPAL WATER DEMAND REDUCTION AND CONSERVATION OPTIONS

Water is a resource many Pioneer Valley residents take for granted. The Pioneer Valley is a relatively water rich region, bisected by New England's longest river, the Connecticut, bounded by the huge Quabbin Reservoir to the east and Cobble Mountain Reservoir on the west, and receiving an average annual rainfall of 43 inches. The question is commonly asked, "with all of the water we have available, why conserve?".

While some of the region's communities currently have water surpluses, others face water supply shortfalls in the next decade due to such factors as polluted wells, rapid growth rates, inadequate water infrastructure, and lack of access to alternative supply sources.

Water conservation makes sense, for a variety of economic, ecological practical, and social reasons. It is vital for communities with project water supply shortfalls, and may be an important strategy even for communities with current water surpluses.

5.1 Water Conservation Policy Statement

The Pioneer Valley Water Supply Task Force adopted the following policy statement, which provides a strong rationale for the need for water conservation in the Pioneer Valley, even in those communities which currently have water supply surpluses:

a. The Need and Rationale for Water Conservation

Communities with water supply deficits should institute water conservation programs for the following reasons:

- Ensuring long-term adequacy of supplies to meet future demand;
- Preventing frequency, reducing severity and mitigating impacts of water emergencies due to pollution, drought, equipment failure, or rapid growth;
- Maintaining capability to meet demand in the event of contamination or loss of a primary water source;
- Preventing excessive water withdrawals, which may result in environmental damage, may require a permit under the Massachusetts Water Management Act, or may increase the zone of contribution of a well and therefore increase the danger of pollution;
- Avoiding excessive capital cost of developing new sources, transmission lines, treatment plants, facilities;
- Extending the life of water supply equipment, including pumps and treatment facilities;
- Protecting consumers from increased water delivery costs, due to the need for new water treatment facilities and other water infrastructure;

- Developing a water conservation plan will aid in approval of permits under the Massachusetts Water Management Act;

- Avoiding the need for purchase of additional water from sources outside the municipality, which are not in the control of the municipality;

Communities with projected water supply surpluses should institute water conservation programs for the following reasons:

- Domestic and business conservation measures (i.e. indoor, non-seasonal) will help in reducing cost of wastewater treatment, prolonging treatment plant lifespan and capacity;

- Maintaining capability to meet demand using existing water sources (including back-up or alternate sources) even in the event of contamination of one or more sources;

- Preventing excessive water withdrawals, which may result in damage to environmental resources, may require a permit under the Massachusetts Water Management Act, or may increase the zone of contribution for a well and therefore increase the danger of pollution;

- Providing for sustainable growth;

- Reducing capital and operating costs for new or upgraded water transmission lines and facilities, including water treatment and storage facilities;

- Providing water to a larger consumer base or additional communities in order to help defray the costs of water delivery;

- Reducing design costs for water treatment facilities, since facilities must be based on peak flows, and peak flow shaving can be achieved by conservation measures;

- Protecting consumers from increased water delivery costs, due to the need for new water treatment facilities and other water infrastructure;

- Extending the life of water supply equipment, including pumps and treatment facilities:

- Developing a water conservation plan will aid in the approval of a permit under the Water Management Act;

b. Implications of Not Instituting Conservation Programs Now

Communities which do not adopt water conservation programs now may face the following impacts in the future:

- Increased water deficits in water deficit communities, and potential deficits in water surplus communities, due to development of new homes, landscaping, businesses, and industries with high water use characteristics.

- If and when water supply exceeds demand, requiring future retro-fitting of conservation devices and measures at costs higher than new construction;

- Increasing water treatment costs, reduced wastewater treatment plant capacity and lifespan, sewer hook-up moratoria;
- Increasing capital costs of developing new water sources, transmission lines, treatment plants;
- Inability of communities to sustain growth or allow new water connections;
- Long-term energy waste for water heating, pumping and treatment, and subsequent impacts on energy costs.

5.2 Conservation-Oriented Water Rate Structures and Pricing Policies

One option for communities to improve water conservation is to create financial incentives for domestic and business water conservation through changes in water rate structures and pricing policies.

a. Effect of Rate Structures on Conservation

There are several types of water rate structures currently employed by Pioneer Valley communities. These types are described below, along with their relative advantages or disadvantages for water conservation.

1. *Unmetered Flat Rate*

The unmetered flat rate is a uniform rate charged to all customers, usually on a six month or annual billing basis, without regard to the amount of water used. This rate structure is commonly used in communities which have not yet installed water meters. While the unmetered flat rate is an improvement over the decreasing block rate (which creates incentives for high water use), it does not promote efficient water use, and control of water use during drought is difficult.

2. *Uniform Block Rate*

The uniform block rate establishes a standard per unit price for water which does not change as consumption increases. This price structure may be somewhat effective in reducing average consumption. It functions as a "middle-of-the-road" pricing policy, in that it does not provide strong incentives for conservation, but also does not encourage wasteful water use. Uniform block rates may be most effective when the unit price is sufficiently high so as to discourage wasteful water use. Large volume users generally consider this pricing structure to be equitable.

3. *Decreasing Block Rate*

In a decreasing block rate structure, the per unit price for water decreases as consumption increases. This pricing structure has been widely used in the industrialized communities of the Pioneer Valley. It is preferred by large volume users because it provides cost savings with increased use. Many communities use decreasing block rates as an incentive to attract industrial and commercial growth. This policy creates disincentives for water conservation, and encourages wasteful water use practices.

4. *Increasing Block Rate*

In the increasing block rate structure, the per unit price for water increases as consumption increases. This policy can be effective in reducing average and maximum demand. It provides financial incentives for water conservation, particularly among large water users. The advantages of the increasing block rate are lower costs for the provision and delivery of water, lower wastewater treatment costs, and conservation of surface and groundwater resources. A disadvantage of this policy is that if the increasing block price levels are not carefully planned, they may be viewed as inequitable by large water users.

Current state law (M.G.L. Chapter 40, Sec. 39J) prohibits communities from using decreasing block rates to charge for water services, effective January 1, 1991. Communities should adopt increasing or uniform block rates.

b. Price Level and Conservation

The price of water has an impact on its usage, and has been shown to be effective in reducing residential peak use, and commercial/industrial average use.

Communities can adopt full-case pricing policies, under which a water utility sets price levels that recover all the direct and indirect costs associated with providing water. Full-cost pricing rates include such costs as capital expenditures, debt service, depreciation, billing and administration. The benefits of full-cost pricing include:

1. Revenues provide adequate funds for regular water system maintenance, protection of quality, and system improvements;

2. Water conservation is encouraged, because water prices are no longer subsidized;

3. All users are charged on an equitable system, based on actual quantities used;

4. Public awareness of the true cost of water is increased.

Establishing "enterprise fund" accounting enables water suppliers to become self-sustaining, to identify the full costs of providing water and to recover those costs through water rates. Enterprise fund accounting has the following benefits:

1. Water utilities are provided with a consistent and reliable level of funding, based on user fees, not general tax revenues. This reduces demands on the municipality's general fund;

2. Water utilities have more control over how revenues are spent, and are better able to improve, maintain and operate the water system. Water revenues are not used to support other municipal services.

c. Metering

Water suppliers must institute universal (100%) metering if they hope to institute full-cost pricing and improved water system financial management. Equitable water usage rates can be charged only if all customers are metered.
In addition, metering can benefit water conservation efforts in several ways:

1. Metering clearly illustrates water use volumes and costs to all users;

2. Increased frequency of meter reading and billing can demonstrate the benefits of conservation practices to users, by illustrating water use trends;

3. Universal metering is necessary to trace unaccounted for water and for leak detection.

5.3 Retrofit of Domestic Water Conserving Devices

The installation of water saving devices in homes offers a lasting and a relatively inexpensive approach to water conservation. Generally such devices can be installed and used without major disruptions in consumer lifestyles.

a. Installation Methods

There are two methods commonly used by municipalities to achieve retro-fit of domestic water conserving devices:

1. *Voluntary Homeowner Installation*

   Municipalities distribute free water-conserving devices, which are made available to homeowners at local outlets. Homeowners are then expected to install the devices themselves. This approach is less costly initially, but may also be less cost-effective since actual installation rates may be lower than #2 below;

2. *Door-to-Door Installation*

   Municipal crews proceed door-to-door to offer free installation of devices in homes, with the residents' permission. This approach has higher initial costs, but may result in high rates of installation and actual water conservation.

A recent study by the Massachusetts Water Resources Authority (MWRA) indicates that direct door-to-door installation achieved five to eight percent water use reductions, significantly higher than voluntary homeowner installation. MWRA's cost of installation was about $23 per household.

b. Types of Water Conserving Devices

The types of water conserving devices which are practical for inclusion in a municipal retrofit program include: faucet aerators, low-flow showerheads and toilet displacement devices.

1. *Toilet Displacement Devices*

   Toilets consume about 40% of total domestic water use. Toilet dams, water displacement bags or weighted plastic bottles, in the tank of high volume flush toilets, will save one to two gallons per flush, depending on tank size.

2. *Low-Flow Showerheads*

   Show aerators or restrictors draw in air to keep flow pressure strong with less water. Showerheads are also made with a shut-off valve so that the flow can be stopped temporarily while, for instance, shampoo is applied. Regular showerheads use about seven gallons a minute, and massaging showerheads use 11-13 gallons. A low-flow showerhead uses only 2.5 gpm, without affecting the strength of the shower.

3. *Faucet Aerators*

   Flow-control faucet aerators reduce flow from six gallons per minute (gpm) or more to .5 - 1 gpm. These devices are easily installed on threaded faucet spouts.

A recent study indicates that annual energy and water cost savings in the first year will pay for the cost of these water saving devices three times over.

5.4 Development Regulations for Water Conservation

Communities can promote water conservation through adopting building codes, sewer codes and development regulations which encourage water recycling in industrial or business uses, low water use landscaping (xeriscapes), reduced lawn sizes, and use of on-site wells for non-potable industrial uses.

It is considerably more cost-effective to construct new buildings and homes with water-conserving features and to lay out new developments with water-conserving designs, than it is to retrofit or modify existing development. Communities, then, can have a significant impact on future water use by establishing building regulations which require water conserving fixtures or designs at little or no extra cost to developers.

a. Mandatory Water Recycling

Commercial car-wash facilities have high water use requirements. Recycling systems on these facilities are feasible, and many newer installations are equipped in their original design.

Communities can adopt requirements in the site plan approval section of zoning bylaws, and/or in their sewer code (requirement to be met prior to issuance of sewer tie-in permit), similar to the following:

> *"All new commercial car-wash facilities shall be equipped with an approved water recycling system on both the wash and rinse units. All existing commercial car wash facilities shall be equipped with such recycling systems, when the systems are replaced."*
>
> *(Source: Northeastern Illinois Planning Commission)*

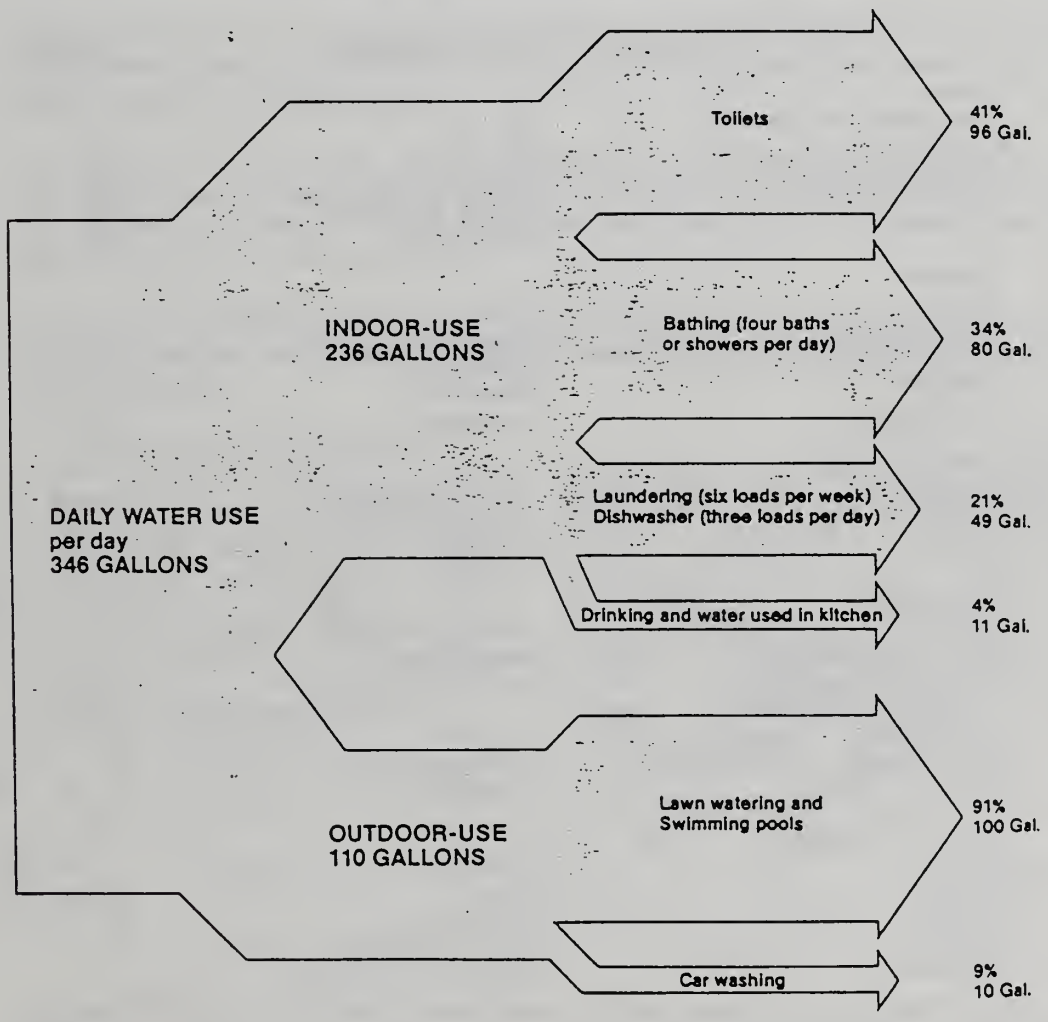
Similarly, it is feasible in many cases to recycle non-contact cooling water in industrial operations. Zoning regulations could also require industrial process water recycling where it is feasible.

Communities can adopt sewer code amendments by majority vote of the City Council/Town Meeting. No public hearing is required. Towns must submit town bylaw changes to the Mass. Attorney General's office for approval, however, City ordinances do not require such approval. Zoning bylaw amendments require a 2/3 majority City Council/Town Meeting vote, public hearing, and Attorney General's approval.

b. Landscaping Requirements

Based on national averages, outdoor water use (for lawns, landscaping, car-washing, etc.) comprises 32% of total residential water use. For a family of four, this outdoor use averages 110 gallons per day (see diagram below). Consequently, managing and conserving this portion of residential use is important, particularly during periods of summer peak demand when almost all New England water emergency or drought declarations occur.

Figure 1. Typical Residential Water Use By A Family of Four (Gallons per Day)



Many southwestern regions and communities, including Los Angeles, Contra Costa, Santa Barbara and Ventura Counties in California, Pima County and Tucson, Arizona have adopted regulations requiring water-conserving landscaping or "xeriscapes".

> *Xeriscape {Greek, xeros, dry} Xeriscape, a concept that originated in the arid Southwest, is based on water conservation through creative landscaping. The principles of Xeriscape emphasize planning and design, soil improvements, mulching, plant selection and maintenance for efficient water use.*

Now the "xeriscape" concept is catching on in other areas of the country. For example, Coral Springs, Florida recently adopted tree preservation and landscape ordinances which promote xeriscape. The tree preservation ordinance requires inch-for-inch replacement of all native plants that are removed from a site. For sites with little or no existing vegetation, the landscaping ordinance requires that 30% of all required trees and 40% of required shrubbery be native species.

In another example, the Mass. Water Resources Authority has widely distributed a brochure to its member communities recommending xeriscapes. It contains the following list of low water use plants, suitable for landscaping in the Northeast.

WATERLESS PLANTS

(Source: Mass. Water Resources Authority)

COMMON NAME	LATIN NAME*	HEIGHT
Trees		
Amur Maple Acer ginnala	20' - 25'	
Austrian Pine	Pinus nigra	50'
Japanese Black Pine	Pinus thunbergii	50'
London Plane	Platanus x acerifolia	50'
White Oak	Quercus alba	50'
Shrubs		
Broom	Cytisus sp.	6"
Flowing Quince	Chaenomeles speciosa	3' - 6'
Junipers	Juniperus sp.	2' - 9'
Potentilla	Potentilla sp.	3' - 4'
Salt-Spray Rose	Rosa rugosa	4' - 6'
Ground Covers		
Bearberry	Arctostaphylos uva-ursi	6" - 8"
Lilies of the Valley.	Convallaria majalis	6" - 8"
Violets	Viola sp.	6" - 8"
Perennials		
Aster	Aster (certain species)	15" - 30"
Common. Blanketflower	Gaillardia aristata	2' - 3'
Sedum (Acre, Red Carpet, Ruby Glow, Stoliniferum Spectabile)	Sedum sp.	2" - 15"
Tawny Daylily	Hemerocallkis fulva	6'
Yarrow	Achilea sp.	4" - 4'
Annuals/Biennials		
Cosmos	Cosmos sp.	3'
Gazania	Gazania	6" - 18"
Marigold	Dimorpotheca sp.	4" - 16"
Portulaca	Portulaca granfdiflora	8"
Strawflower	Heliochrysum bracteautum	3'

The new Los Angeles landscape code encourages developers to limit turf (sod and grass) to no more than 25 percent of the total landscaped area. The xeriscape code gives developers "points" for using water-conserving landscaping. In order to obtain a building permit, a minimum number of points must be gained through:

- ground cover or vegetation that uses little water;
- irrigation systems that are electronically set for night or early morning;
- designs that collect and recycle water.

Los Angeles County estimates that the landscaping regulations, combined with other water conservation measures can save 10% of total water use. El Paso, Texas estimates that xeriscape principles can cut its outdoor water use in half.

In less arid sections of the country, water conserving landscaping can help to minimize outdoor water use demands during the peak demand periods of the dry summer months when supplies are pushed near their limits.

c. Cluster Developments

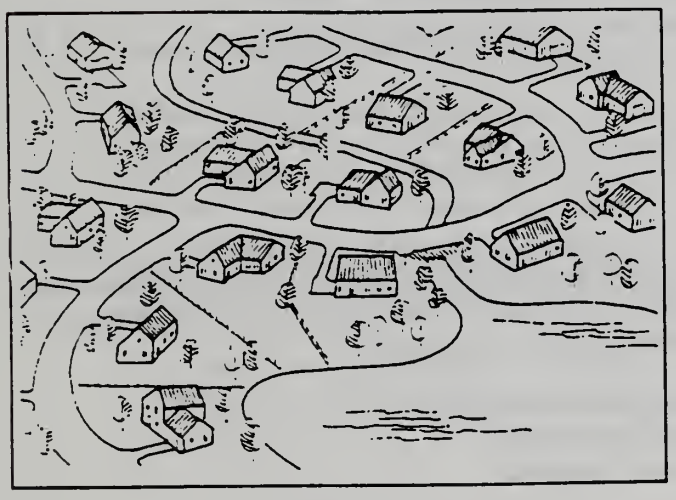
Cluster developments offer communities the opportunity to achieve multiple objectives. In addition to preserving open space and providing a more efficient pattern of land use, clustering can be helpful in promoting water conservation.

Cluster developments, or "open space developments" as they are often called, generally allow development on smaller lots provided that 50% or more of the total development parcel is preserved as open space.

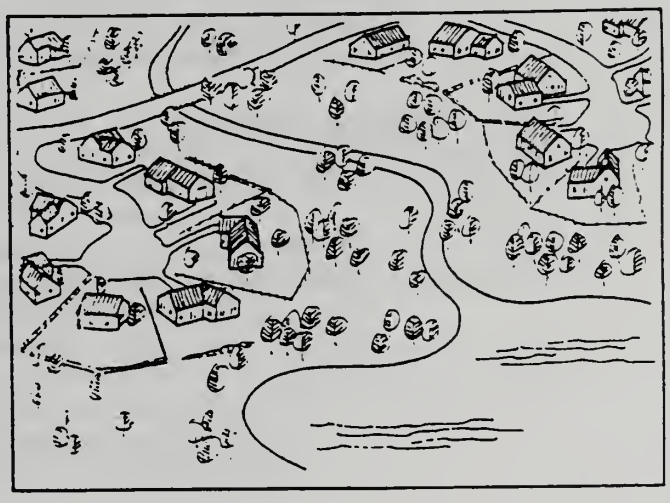
According to a recent study, "Water Conservation in Residential Development--Land Use Techniques" (Sanders and Thurow), the water conservation benefits of cluster developments are twofold. First, the individual homeowner's lot is smaller with less area devoted to lawns and gardens.

Second, the common areas are more easily designed to be water efficient. Often, common space is not landscaped but maintained with native vegetation that does not require irrigation.

CONVENTIONAL DEVELOPMENT



CLUSTER DEVELOPMENT



Source of Graphic: "Water Conservation in Residential Development" (Sanders and Thurow)

d. On-Site Non-potable Water Supplies

Often, industrial water users utilize water for processes that do not require water meeting drinking water quality standards, (i.e., non-contact cooling water). Particularly for large users, it may be cost-effective to develop on-site wells to provide for such non-potable uses.

Connections to municipal water systems require a permit from the Board of Public Works or other water authority, in accordance with a town bylaw or city ordinance. Communities can amend such local ordinances, in cases where water supplies are severely limited, to limit water system hook-ups. For example, a community with a projected water supply deficit could adopt a municipal ordinance permitting industrial water connections for potable water needs, but requiring an on-site hydrological study to assess the feasibility of developing an on-site water source for non-potable needs. Such a program should be carefully designed to ensure its consistency with the Mass. Water Management Act.

5.5 Enforcement and Improvement of State Plumbing Code

In 1988, the State Plumbing Code was amended to require that low-flow toilets (1.6 gallons per flush) be used in all new construction, renovation and other toilet installations by a licensed plumber. In order for this new law to be effective, it is important that local plumbing inspectors be aware of the code change, and be actively involved in enforcing it.

Further changes to the State Plumbing Code have been proposed by the MWRA to promote water conservation. If adopted, these changes would prohibit wasteful industrial water use practices, such as one-through use of non-contact cooling water, and establish requirements for low-flow faucets, showerheads and urinals. These are important changes for water conservation, and should be supported and enforced upon adoption.

5.6 Public Education on Water Conservation

Educational programs can be designed to reach a broad cross-section of the general public, and can be useful in raising public awareness of the need for conservation. Educational efforts ben be targeted toward:

- Adopting good water use habits, indoors and outdoors;
- Encouraging household leak detection and repair on a regular basis;
- Replacing inefficient water fixtures and appliances.

a. Types of Programs

1. *School Programs*

Children can exert a great impact on their families' water consumption. A number of useful school curriculum guides and educational programs on water conservation have been developed, and are readily available. A particularly useful example are the curriculum guides developed by MWRA which include:

- "Water Wizards" for elementary school students
- "Water Wisdom" for middle school students
- "Water Watchers" for high school students

Copies of the curriculum guides are available from:

MWRA School Programs
Charlestown Navy Yard
100 First Avenue
Boston, MA 02129

2. *Educational Brochures and Guides*

Many effective educational brochures and guides on residential water conservation have been developed and are readily available. For example, the following materials are available through MWRA:

- "Home Water Conservation Guide" --includes 20 tips to help residents save thousands of gallons of water each year

- "Garden and Landscaping Water Conservation Tips"--ideas for water-less plantings, drip irrigation, lawn watering, etc.

Other water conservation materials are available from American Water Works Association.

Educational brochures can be distributed to water customers as inserts to water bills, or can be made available at municipal offices and local stores.

3. *Other Educational Programs*

Other educational programs which can be used to promote water conservation include:

- Public service announcements on radio and television
- Bus posters
- Public speaking engagements at civic organization, club, business organization meetings
- Media or press releases
- Special events

5.7 Leak Detection and Repair

A faucet leaking one drop of water per second wastes up to 200 gallons per month. Leaks in municipal water mains can waste thousands or even millions of gallons of water. In fact, a recent annual leak detection survey conducted by the MWRA discovered a total of 87 leaks which resulted in water losses of 3.8 millions gallons per day!

Leak detection programs can greatly improve water system management and provide a big payoff for water utilities. They can be undertaken by two methods:

1. *Consultant:* Leak detection consultants may be hired to complete all detection work, or to train municipal employees in leak detection;

2. *Municipal Personnel:* Municipal public works or water departments may purchase geophones and related leak detection equipment (for about $2,000) and undertake the work themselves. Equipment could also be purchased jointly with neighboring communities, since each community will only need to use the equipment for approximately two weeks (per year, or bi-annually).

Leak detection efforts should be undertaken bi-annually, and repairs to leaks made promptly after identification.

Other sources of unaccounted for water, which should be investigated and corrected include:

1. Meter under-registration
2. Meter tampering
3. Illegal fire hydrant openings
4. Illegal connections

6.0 BUSINESS AND INSTITUTIONAL WATER CONSERVATION OPTIONS

6.1 Assessment of Current Practices

In order to assess current water use and conservation practices among Pioneer Valley Businesses and institutions, PVPC under took a survey of the region's 125 largest employers. Each business or institution surveyed employed 100 or more persons. The survey response rate of 33% indicates a relatively high interest in this issue. The following sections summarize survey results. A copy of the survey form is contained in Appendix A.

a. Type of Respondents

The forty-two respondents to the survey were of the following types:

13- Industrial; manufacturing
12-Hospital; health care institution
9-Business; service
8-School; college; university

b. Water Source

The survey investigated whether businesses utilize municipal or private on-site water supplies. Thirty-four of forty-two respondents (81% of total) derive all of their water from municipal water supply sources. Five respondents (12%) derive a portion of their water from on-site wells, including a car wash chain, an amusement park (for air conditioners), an industry, a hospital (for fire protection purposes only), and a large business (for watering lawns). Three respondents (7%) use on-site wells for all their water needs, including a paper company a high school, and an institution. Only three respondents reported the volume of water used from on-site wells, which totaled 180,000 gallons per day.

c. Volume of Water Used

Twenty-five respondents reported total water use, ranging from a low of 3,000 gallons per day to a high of 9,200,000 gallons per day. The highest volume water users reporting were:

Monsanto Chemical Co.	9,200,000 gallons per day
University of Massachusetts	1,700,000 gallons per day
Spalding Sports Worldwide	1,600,000 gallons per day

None of the other businesses or institutions reported using over 250,000 gallons per day. The average water use per business/institution was 569,000 gallons per day, however, excluding the above three large users, the average was 79,000 gallons per day. Seventeen respondents did not know how much water they used.

d. Types of Water Use

The predominant water use type among the responding businesses and industries is for domestic purposes, followed by cooling and process uses.

Water Use Type	Primary Use Reported By Number of Respondents	Secondary Use Reported By Number of Respondents	Tertiary Use Reported By Number of Respondents	Most Frequent Type of Business Reporting Primary Use
Cooling	10	12	7	Industry
Process	8	10	3	Industry
Domestic	27	7	9	Institution
Other	1	4	4	Business

In general, industries used the largest quantities of water for cooling and process purposes. Institutions (mainly hospitals, colleges, schools) used the largest for domestic purposes.

e. Change in Future Demand

Most respondents (39%) were not sure whether their water demand would increase or decrease in the next ten years (these were the same respondents which did not know their current use). Twenty-seven percent (27%) of respondents anticipated increased demand, while 19% anticipate decreased demand, and 15% expect demand to remain level. Notably, two companies expect large drops in water usage due to internal recirculation of water and complete analysis of conservation techniques. (See next section for example: Spalding Sports Worldwide).

f. Water Audits

Fifteen respondents (36%) indicated that they have already performed water audits to determine where water is being used within the business and how cost-saving conservation measures can be employed. Twenty-seven respondents (64%) indicated that no water audit had been performed. There was strong interest among respondents in having a water audit performed. Twenty-one respondents (70%) would consider undertaking a water audit, while 5 respondents (17%) would not, and four (13%) were not sure.

g. Water Conservation Measures

Fully 79% of all respondents have utilized at least one water conservation measure. Half of all respondents indicated they have utilized recirculation of cooling water, or leak detection and repair. The following table summarizes existing conservation measures:

Conservation Measure	No. of Respondents Utilizing	% of Total Utilizing
Leak detection and repair	22	52%
Recirculation of cooling water	21	50%
Recycling of process water	16	38%
Automatic shutoff valves or faucets on process equipment	11	26%
Retro-fitting low-flow toilets or faucets for domestic uses	8	19%
Water restrictors	6	
Consolidation of water-using operations	4	14%
On-site non-potable wells for process water or landscape watering	3	7%
Other (low-flow showerheads, outdoor watering, etc)	4	9%
None	9	21%

h. Retro-fitting Water Conservation Devices

Twenty-five respondents (60%) indicated they would consider retro-fitting their business or institution with water conservation devices and measures, if it can be shown that the devices/measures would pay for themselves within a modest period of time. Two respondents (5%) would not consider retro-fitting, and 15 35%) were not sure.

i. Interest in Conservation Workshop

There was a high degree of interest in attending a workshop with presentations from companies who have successfully saved money by installing water conserving devices and procedures. Twenty-nine respondents (69%) indicated a willingness to attend such a workshop.

j. Conclusions

The survey indicates that many businesses and institutions have already given serious consideration to water conservation measures. However, a majority of business/institutions have not performed a water audit, and nearly half did not know how much water they used. A large majority of businesses/institutions are willing to consider cost-saving water conservation measures.

Consequently, municipalities may be able to achieve strong business/ institutional participation and significant water savings by:

1. Coordinating technology transfer workshops on business water conservation;
2. Providing or facilitating low-cost water audits.

6.2 Case Study: Spalding Sports Worldwide, Chicopee

a. Type of Manufacturing/Corporate Philosophy

Spalding has been a leading manufacturer of sporting goods for over 100 years. Spalding's Chicopee facility is a light-duty manufacturing company specializing in production of golfballs, golfclubs and softballs.

Spalding's corporate policy is to "invest in research and development", to maintain product superiority, and to "be a leader" in their field. Spalding applies that scientific leadership philosophy to the community and the environment. This policy led directly to the development of a water conservation plan. Spalding believes the most environmentally sound approach will become the most economical.

b. Development of Water Conservation Plan

In 1980, Spalding was one of the top water users in Massachusetts. Sixty percent of their water use was for cooling purposes. The Chicopee facility initiated a 10-year water conservation plan in 1982, prior to today's current economic motivation and sewer and water rate increases. Their sewer permit, which requires that discharge of non-contact cooling water be eliminated, is to be renewed in 1992.

Spalding's first step was to involve the entire floor staff in identifying where and how water was being used. The second step was to evaluate, monitor and test processes to determine the volume of water used versus the actual amount required.

c. Water Conservation Methods

The plan Spalding developed achieved water use reductions through: process equipment design change; or, replacement of equipment with more water-efficient equipment and recycling systems.

One procedural change that resulted in less strain for workers as well as the reduction of water involved the design of a device that could mechanically remove hot parts from a press. Previously, water cooled the parts so that employees could remove them.

In other processes, molds were made more accurate and trimming was changed from a water-intensive process to a mechanical process using mineral water which could then be recycled after filtration/separation of trimmings.

Air cooled compressor cooling units replaced many water cooled units; water was recirculated in the remaining units. Cooling towers were installed to recirculate cooling water.

In many instances minor changes resulted in large savings without impact upon efficiency. For instance, water comes into the plant at 140 pounds per square inch. Their equipment only needs 60-70 psi, so pressure reduction valves were installed. Also the size of the water lines delivered more water than was necessary in a washing operation. Portions of the line proceeding washing, were replaced with a smaller size line at a cost of only $100.00.

d. Results of Water Conservation Program

Since Spalding's conservation procedures have been phased in, water consumption at its Chicopee facility will be reduced by 96.7% or 478.8 million gallons of water annually by 1991-1992. As part of this program, Spalding was able to eliminate 100% of its non-contact cooling water (321 million gallons per year). Spalding's annual cost savings for water use will be approximately $24,000 at Chicopee's current water rates, but these savings may climb as high as $478,000 per year when Chicopee's contract with Massachusetts Water Resources Authority is renegotiated in 1999.

6.3 Other Examples of Successful Business/Institutional Water Conservation

The Massachusetts Water Resources Authority (MWRA) has published a series of detailed papers summarizing the results of water audits and conservation programs in a variety of large and small businesses and institutions. Examples provided range from large industries to a car wash, a restaurant and a YMCA. The papers provide detailed information about conservation techniques employed, costs and savings.

The MWRA's publication Water Conservation Strategies for Industry, Retail Businesses, Schools, Hospitals, Utilities, Hotels, and Recreational Facilities is an excellent publication, which briefly summarizes four of the best water conservation examples in the Boston area:

The Gillette Company Blade and Razor Division *(Boston) reduced its water use from 730 million gallons per year (mgy) in 1972 to 156 mgy in 1982, a 78% reduction with an estimated payback period of 1.33 years (at 1982 rates). Conservation methods included 1) employee awareness programs; 2) the installation of air conditioning/process cooling loops; 3) a washing water recirculation system; and 4) the development of non-potable water sources.*

The Lenox Hotel *(Boston) recently installed 160 low-flow tank-type toilets that use just 1 gallon per flush and retrofitted 60 flushometers with conservation kit diaphragms that save 1 gallon per flush. They also installed water-saving showerheads that use only 2.5 gallons per minute and faucet aerators that use.5 gallons per minute. Together, these changes are expected to save 300,000 gallons of water per month. The payback period for these improvements, initially estimated at 2.5 years, was reduced to less than 2 years at 1989 rates.*

The Cambridge Family YMCA *(Cambridge) allocated 85,000 to repair two leaky heater coils, replace faucet aerators and washers, and repair plumbing in the athletic facility and 136 guestrooms. Conscientious leak repair and maintenance has saved $31,000 on water and sewer bills in the past two years and has reduced water use by more than 30%. Although the 92-year-old building will eventually be replaced by a new facility, the rapid payback and magnitude of savings made water conservation a very wise investment.*

The General Electric Company *(Lynn) has, over the last 10 years, reduced its water use by more than 30% (1,365,000 gallons per day) by installing closed loop cooling systems and expanding the steam condensate return system. In 1988, GE saved an additional 11% of total water use entirely through aggressive maintenance, repair and employee awareness efforts:*

- *Power plant supervisors perform weekly water use "audits" by checking meters, pipes and drains for leaks and waste.*

- *The maintenance department presents an award to the crews that fix the largest number of leaking water fountains, faucets or stuck flushometers.*

- *Articles on water use appear regularly in the company newsletter.*

Since 1974, GE has invested more than $2 million in water conservation projects.

6.4 Business Water Conservation Options

The Massachusetts Water Resource Authority has undertaken extensive water conservation activities with business and institutional water users, including completing 40 water audits, and working with over 450 companies or institutions. MWRA estimates that a 3-year payback is typical for many business or institutional water conservation measures. MWRA estimates that by employing those water conservation practices with 3-year payback, a 15-20% savings in total municipal water use can be achieved for a typical community.

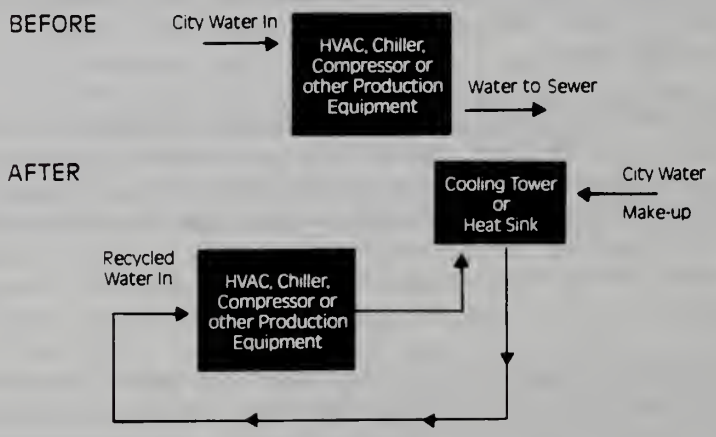
The following four-part business and institutional water conservation strategy is recommended in MWRA's Water Conservation Strategies for Industry, Retail Businesses, Schools, Hospitals, Utilities, Hotels and Recreation Facilities:

1. Cooling & Heating Systems

The amount of fresh water needed to cool processing equipment, mechanical systems and air conditioning can often be greatly reduced.

- Closed-loop cooling systems, while more expensive to install, recycle the same water and may actually enhance cooled equipment performance by maintaining a constant temperature.

- Non-potable water (recycled, reused or treated wastewater) is frequently suitable for use in cooling systems.



Once-through cooling of air-conditioning units or chillers - Most industrial and commercial enterprises use large quantities of water to cool production, air conditioning and utilities support equipment. This water can be recycled very efficiently.

- Temperature-sensitive valves can be installed to modulate water flow in response to the actual temperature of the process, and to turn off water when the equipment is shut down.

- Air cooling should be substituted for water cooling whenever possible.

- Avoid excessive boiler and cooling tower blowdown. Adjust blowdown rate to maintain total dissolved solids (tds) of 2000 parts per million (ppm) or higher.

- Be sure maximum quantities of steam condensate are returned to the boilers.

- Investigate the possibility of changing from cooling tower treatment to ozone to reduce the need for make-up water.

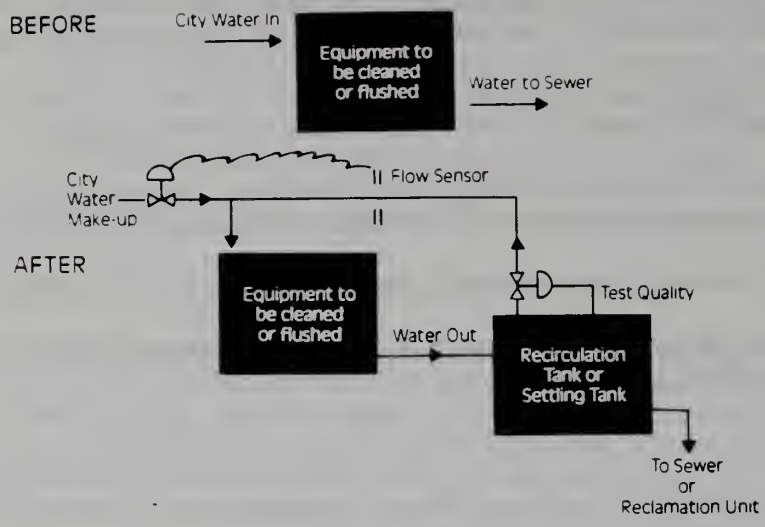
2. Process Use

Process and cooling use can consume 80% of the water needed by industrial users. Because each processing system is unique, general demand management procedures should be adapted to suit your company's needs.

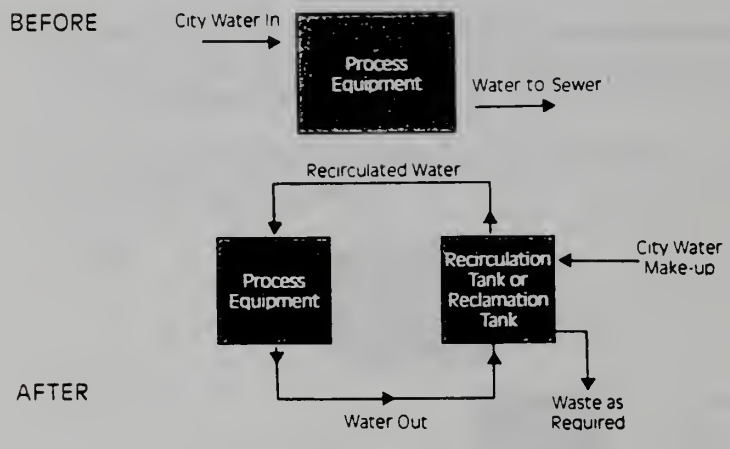
- Review all systems to determine if present water uses are necessary and if the latest water-saving technology is being utilized.

- Whenever possible, use alternate sources of water such as wells, rivers and ponds.

- Use multiple rather than single rinses.



Equipment cleaning and flushing
- Many industries use large quantities of water to clean or flush equipment used in the manufacture of a product. This process can often be modified to use far less water by treatment and recycling. This may also allow the user to salvage a valuable product presently being thrown away in wastewater, such as metals or chemicals.



Process water used by in-plant equipment - Vast amounts of water are used in processing and manufacturing. Creative conservation through recycling, reuse, better controls and/or modifications to the process or equipment will result in reduced water use; this is especially true in the chemical, food processing, paper making and electronics industries

3. Sanitary Use

Among commercial users such as hospitals, hotels and office buildings, 80% of all water is used in bathrooms and kitchens.

- Install efficient, water-saving fixtures such as faucet aerators, toilet dams, and showerheads that use 3 gallons per minute or less.
- Install low-flow toilets. *As of March 2, 1989, the Massachusetts Plumbing Code requires the use of low-flow tank-type and floor-mounted flushometer toilets using 1.6 gallons per flush or less in all new and replacement installations.*
- Encourage employees to report leaks.
- Promote water-saving habits.

4. Maintenance Operations

Routine maintenance procedures will help locate problems quickly, keep equipment operating at peak efficiency and maximize the results of your demand management program.

- Document and enforce a routine leak detection and repair program.
- Install spring-loaded (dead-man) valves or timers on all manually operated water outlets.
- Reduce water use for landscaping, gardening or groundskeeping. Install timers, and either tensiometers (soil moisture indicators) or rainfall sensors on automatic sprinkler systems to be sure grounds are watered only when necessary.
- Consult a landscaper about low water use plantings and techniques.
- Put automatic shut-off nozzles on all hand-held hoses.

6.5 Promoting Business Water Conservation

There are several ways that municipalities can promote water conserving practices among local businesses and institutions including:

a. Water Audits:

Municipal water department can develop staff expertise to perform water audits, or can hire a water audit consultant to provide such services to businesses and institutions in the service area on a fee-for-services or reduced cost basis.

b. Technology Transfer Workshops

Communities can cooperate with their regional planning agency, local Chambers of Commerce and other groups to co-sponsor technology transfer workshops on water conservation for businesses and institutions. Expert guest speakers are available from the many businesses and institutions which have already had direct experience in implementing water conservation programs. In addition, papers and a manual summarizing the results of various individual business water conservation applications are available from MWRA.

7.0 WATER SUPPLY PROTECTION OPTIONS

Water is a valuable resource that needs to be protected to ensure its availability in sufficient quantity and quality to support the future needs of the region. The degree of threat to the Pioneer Valley's water supply resources is exemplified by the recent closing of six public supply wells in five communities due to contamination. Many municipalities are walking a tightrope created by increasing demand for water as populations grow, and increasing contamination potential created by development on or near watershed and aquifer recharge land.

7.1 Water Supply Protection Policy Statement

The Pioneer Valley Water Supply Task Force adopted the following policy statement concerning the protection of existing and future water supplies. This policy statement emphasizes the protection, rather than the clean-up of water supplies in order to avoid the costly, and sometimes ineffective treatment of contaminated supplies.

a. The Rationale for Water Supply Protection Strategies

- Ensuring long-term quality of supply;
- Ensuring long-term quantity of water will be available to meet future development demand;
- Avoiding expensive emergency clean-ups;
- Avoiding excessive capital costs of treatment plants;
- Protecting town residents from increased water delivery costs due to the need for water treatment facilities;
- Reducing severity, frequency and impact range of potential contamination;
- Avoiding the need for purchase of additional water from outside the municipality.

b. Implications of Not Instituting Protection Strategies

- Increasing or potential water deficits due to new development;
- Increasing water treatment costs;
- Increasing capital costs of developing new water sources, transmission lines, treatment plants;
- Inability to sustain growth or allow new water connections.

7.2 Local Water Supply Protection Options

This section provides a brief summary of protection strategies that have proven effective in helping municipalities protect their water supplies. Their effectiveness relies not only in their development and design to meet the special needs of each community, but in coordination between town boards and among communities who share aquifer and recharge lands. Therefore, Section 7.3 also provides a brief discussion of cooperative, multi-

community efforts at water protection. The development of multi-community strategies to protect water, while built on the foundation of local protection efforts, probably represents the most effective way of protecting water supplies in the future.

An important first step in any water supply protection efforts is detailed analysis and mapping of public water supplies, private wells, and the sources of possible contaminants. This information can serve as a reference for future planning, and may promote cooperation with other towns to protect a common source of water.

a. Involving Municipal Officials and Boards

Many community officials and boards should be involved in the protection of water. Particular attention should be paid not only to involving all appropriate groups in the development of protection strategies, but in formalized methods of keeping all parties informed once plans are in place.

Drinking Water Protection - Who's Involved

Responsible Group	Protection Measure	Issue Addressed
Building Inspector	• Water supply zoning overlay district	Enforcement of bylaw
Conservation Commission	• Wetland Protection Regs.	Stormwater runoff control
Zoning Board of Appeals	• Special Permit	Commercial/Industrial pollution sources
Planning Board	• Site Plan Review	Commercial/Industrial pollution sources
	• Water supply zoning overlay district	Prohibit hazardous land uses Establish appropriate lot size
	• Subdivision Review	Drainage/Runoff control
Fire Department	• Underground fuel storage bylaw	Fuel leakage
Board of Health	• Hazardous materials storage bylaw	Spillage/leaks
	• Emergency response	Coordination of mutual aid
	• Septic systems regulations	On-site wastewater disposal
Water Department	• Watershed monitoring and management	Water quality
	• Land acquisition	Long-term water resource protection
Dept. of Public Works	• Roadsalt policies	Roadsalt

a. Selecting Appropriate Protection Strategies

The strategies outlined in the following section provide a wide range of options for water supply protection. Each of these strategies has been successfully adopted and implemented by one or more Pioneer Valley communities (see map), "Communities with Adopted Water Supply Protection Strategies").

1. Communities can adopt a Water Supply Protection Overlay District for sensitive areas. Such districts need to be based upon well-defined and mapped aquifer recharge and watershed areas. The overlay creates additional restrictions and limitations on land uses which are superimposed on underlying districts. These restrictions prohibit or regulate uses which are known to use materials which are hazardous to water supplies. The overlay zone should also establish a special permit process for all new commercial or industrial uses to provide additional scrutiny of these uses in accordance with performance standards.

2. Communities can prevent salt contamination of public and private water supplies by developing effective ways to reduce road salt use and control its storage. In order to do this, communities need to involve local citizens in a committee that will undertake a investigation of sources of salt contamination, local traffic and highway conditions and alternatives to road salt use. A roadsalt policy statement can then be developed and adopted by the community, identifying "best management practices" which should be employed to reduce salt impacts on environmentally sensitive areas.

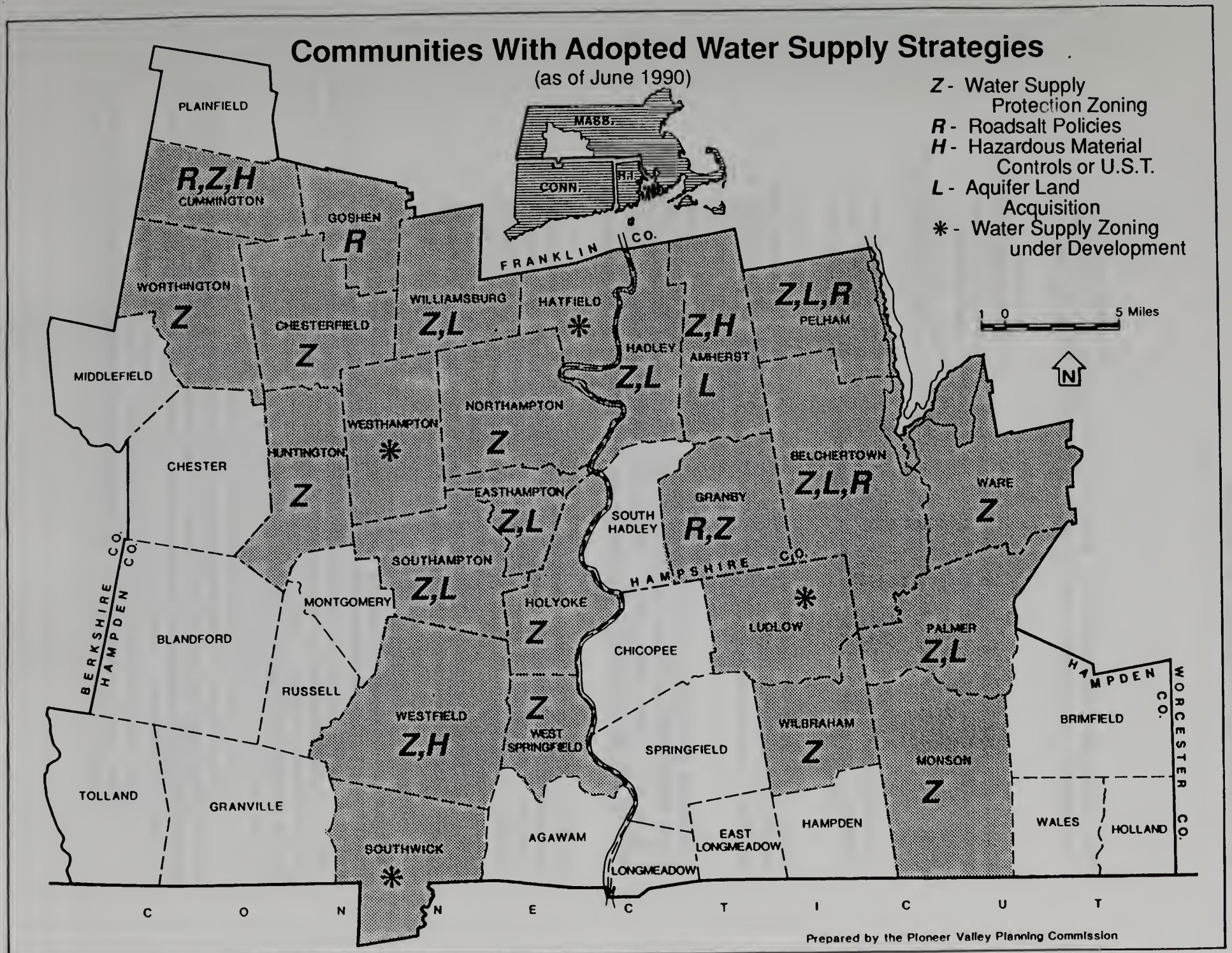
3. Communities can adopt local bylaws requiring underground storage tank and hazardous materials storage registration. These bylaws require that the Fire Department or Board of Health be notified of all underground fuel storage, and of storage of hazardous materials in commercial quantities. Performance standards for safe storage are established.

4. Acquisition of watershed and aquifer recharge land provide the most lasting and effective means of protecting water supplies. Communities can develop programs for land purchase and can use special enterprise accounts to easement and control funds.

5. Private wells need to be protected locally, since no state regulations for this purpose exist. Boards of Health can adopt private well regulations to require proper well installation, water testing and safe distances from septic systems.

6. Municipal planning boards can take an active role in protecting groundwater supplies by adopting subdivision regulations with strict measures to control drainage and urban run-off impacts on water supplies. These regulations should maximize groundwater recharge, limit paving over recharge areas and prevent pollution from run-off.

7. Effective spill response plans can significantly reduce the impact of spills and other potential pollution emergencies by providing for early detection, notification, and a coordinated response.


Communities With Adopted Water Supply Strategies
(as of June 1990)
Z - Water Supply Protection Zoning
R - Roadsalt Policies
H - Hazardous Material Controls or U.S.T.
L - Aquifer Land Acquisition
* - Water Supply Zoning under Development
MASS.
CONN.
R.I.
1 0 5 Miles
N
PLAINFIELD
R,Z,H
CUMMINGTON
GOSHEN
R
WORTHINGTON
Z
CHESTERFIELD
Z
WILLIAMSBURG
Z,L
HATFIELD
*
FRANKLIN CO.
HADLEY
Z,L
AMHERST
Z,H
L
PELHAM
Z,L,R
MIDDLEFIELD
WESTHAMPTON
*
NORTHAMPTON
Z
HUNTINGTON
Z
CHESTER
EASTHAMPTON
Z,L
SOUTH HADLEY
GRANBY
R,Z
BELCHERTOWN
Z,L,R
WARE
Z
BERKSHIRE CO.
HAMPDEN CO.
SOUTHAMPTON
Z,L
HAMPSHIRE CO.
MONTGOMERY
HOLYOKE
Z
CHICOPEE
LUDLOW
*
PALMER
Z,L
BLANDFORD
RUSSELL
WESTFIELD
Z,H
Z
WEST SPRINGFIELD
SPRINGFIELD
WILBRAHAM
Z
MONSON
Z
HAMPDEN CO.
WORCESTER CO.
BRIMFIELD
TOLLAND
GRANVILLE
SOUTHWICK
*
AGAWAM
EAST LONGMEADOW
LONGMEADOW
HAMPDEN
WALES
HOLLAND
CONNECTICUT
Prepared by the Pioneer Valley Planning Commission

7.3 Regional/Water Supply Protection Strategies

Where multi-community recharge areas and watersheds exist, the most effective method of protecting the water supply is through the development of multi-community water protection agreements.

Two regional protection options are presented here. Both require the formation of a multi-community advisory board, comprised of local representatives, to develop and implement regional water supply protection strategies.

a. Multi-Community Water Protection Agreements

A regional protection strategy can be formalized through the adoption of Intermunicipal Memorandum of Agreement between communities which share water resources. Under these agreements, tasks undertaken to protect mutual water resources are coordinated through a Water Supply Protection Advisory Committee. The role of each participating community and organization in protecting regional water resources is clearly identified.

The process for establishing an intermunicipal water protection program is as follows:

- establish task force of local officials to consider cooperative water protection strategies;
- develop Memorandum of Understanding between participating communities and organizations;
- adopt Memorandum of Understanding in each participating community and organization;
- appoint members to a standing water supply advisory committee created by the Memorandum of Understanding;
- develop and prioritize regional water supply protection strategies;

A regional water supply protection strategy could include the following components:

- establish procedures for intermunicipal notification and review of developments of regional impact;
- establish cooperative spill response plan for hazardous chemical spills;
- coordinate equal level of water supply protection zoning control in each community;
- develop application for "Area of Critical Environmental Concern" under the Massachusetts Environmental Policy Act, if appropriate;
- develop application for "sole source aquifer" designation under U.S. Environmental Protection Agency guidelines, if appropriate;
- coordinate acquisition of water supply lands;
- evaluate and develop joint mitigation strategies for existing or potential contamination sources;
- coordinate public education efforts on water protection;
- conduct joint household hazardous waste collections;
- coordinate equal level of local control for underground storage tanks and hazardous materials storage
- develop and implement outreach measures to implement local bylaws (i.e. workshops for public officials on water protection zoning);

b. Regional Water Districts

Multi-community water protection efforts can benefit from the creation of regional water districts under the authority of Chapter 361 of the Massachusetts General Laws. This recently enacted law provides for the establishment of regional water districts by the majority vote of town meetings or city councils in the proposed district.

Once a district is established, the law requires the creation of a drinking water protection commission consisting of two members from each participating community. The commission has the authority to assist municipalities in the following areas:

1. identification and protection of recharge and watershed areas for existing water supplies, and identification of future drinking water supplies;

2. designing regional land use management efforts for seasonal drinking water resources;

3. provide funds to assist municipal efforts to acquire or manage lands identified as important to drinking water resource supply and protection;

4. provide for public education, regarding water conservation, proper waste disposal and land use in recharge or watershed areas;

5. supplement local emergency response systems in cooperation with the Department of Environmental Protection incidence response division, with teams which shall be available to respond and assist where hazardous waste or chemical spill occur within a recharge or watershed area;

6. coordinate, educate and disseminate information to the public on water supply protection;

7. review and comment on proposed land uses which may have an impact on water supply resources;

8. make available to private property owners grants for the removal of underground storage tanks considered to be a threat to drinking water resources.

8.0 PROGRAMS AND LEGISLATION TO PROMOTE WATER CONSERVATION OR PROTECTION

There is a large array of state and federal programs, legislation and regulations which affect drinking water supplies, and in some manner, affect water conservation or protection. These programs may present a complex intricate, and confusing picture to the uninitiated layperson. The purpose of this section, then, is to provide a brief summary of the key points of water protection or water conservation-related programs and legislation.

8.1 Federal Safe Drinking Water Act

Adopted: 1974, Amended 1978 and 1986

Purpose: To establish quality standards for drinking water delivered to consumers.

Enforcement: U.S. Environmental Protection Agency

Key Provisions:

- 1986 amendments require filtration and disinfection for nearly all surface water supplies*;
- Requires development of groundwater programs for wellhead protection;
- Requires EPA to develop drinking water standards and define treatment techniques for 83 listed contaminants.

*Note: The SDWA regulations establish a waiver provision which provides exemptions to the filtration requirement for communities which develop a water resource protection plan or meet criteria for water quality.

8.2 Massachusetts Water Management Act (Mass. General Laws Chapter 21)

Adopted: 1985

Purpose: To determine and maintain the safe yield of watersheds, and create a unified comprehensive permitting process to regulate surface and groundwater use.

Enforcement: Massachusetts Department of Environmental Protection

Key Provisions:

- Requires registration of existing water withdrawals greater than 100,000 gallons per day (gpd);
- Requires permit for new water withdrawals above 100,000 gpd, any increase in a registered withdrawal, or continuation of an unregistered withdrawal;
- Department of Environmental Protection (DEP) must deny any new permit if the new withdrawal will exceed safe yield of the resource;

- Establishes procedures for DEP declaration of water emergencies, which allows water supplier to purchase water from another public system, or take land in any town for water supply by eminent domain. DEP may require preparation of water emergency plan which includes water conservation, leak detection and demand management measures.

Associated Regulations:

- 313 CMR 2.00 requires Department of Environmental Management to develop comprehensive river basin plans to assess basins' abilities to meet water supply needs, and requires municipalities to develop local water resources management plans;

- 313 CMR 36 establishes Department of Environmental Protection regulations for water withdrawal permit applications and evaluation procedures, including requirement of a water conservation plan as part of any appreciation.

8.3 Massachusetts Interbasin Transfer Act (Mass. General Laws Chapter 21, Sec. 8B-D)

Adopted: 1983

Purpose: To establish a procedure to ensure a community will conserve water and use all existing, viable local sources before taking water from another watershed.

Enforcement: Mass. Water Resources Commission (MWRC)

Key Provisions:

- A permit from MWRC is required for new interbasin transfers and for structural changes which may cause increases in existing transfers;

- MWRC reviews all applications for interbasin transfers based on eight criteria which evaluate the extent to which the community has conserved water and developed local resources.

Associated Regulations: 313 CMR 4.00

8.4 Massachusetts Plumbing Code

Adopted: Amended, 1988

Purpose: Amended to require the installation of water-conserving toilets.

Enforcement: State Plumbing Board, local plumbing inspectors

Key Provisions:

- Requires the installation of toilets which meet 1.6 gallon per flush requirements (replacing 3.5 gallon requirement) in all new construction, renovation or other installation of toilets by a licensed plumber.

8.5 Massachusetts Drinking Water and Water Supply Regulations (310 CMR 22.00 - 26.00)

Adopted: Ongoing

Purpose: To establish standard for, and to protect, drinking water supplies

Enforcement: Massachusetts Department of Environmental Protection

Key Provisions:

- Proposed amendments (310 CMR 22.21) require that a wellhead protection bylaw, consistent with state regulations, must be adopted and implemented prior to any new well being brought on-line;

- 310 CMR 26.00 establishes rules governing state grant programs for leak detection and system rehabilitation.

8.6 Massachusetts Drinking Water Protection Act (Chapter 361, Acts of 1989)

Adopted: 1989

Purpose: To promote water conservation, resource management and protection, and resource planning of drinking water supplies.

Enforcement: Multi-community drinking water protection districts.

Key Provisions:

- Enables the establishment of multi-community "drinking water protection district" for communities sharing surface or groundwater resources, with a "drinking water protection commission";

- Enables commission to adopt a pricing system, charging water users a maximum 10% of annual water costs, to carry out its activities. The commission may also issue bonds and apply for state funds;

- Enables the commission to exercise the following powers or authority:

    1. Assist in identifying and protecting recharge and watershed areas
    2. Regional land use management
    3. Assist communities in land acquisition
    4. Provide public education
    5. Supplement local emergency response systems for chemical or waste spills
    6. Coordinate state or federal grants
    7. Review and comment on proposed land uses
    8. Make grants to property owners for UST removal.

8.7 Massachusetts Public Water Supply-Service Charges Act (Amends M.G.L. chapter 40, Section 39J)

Adopted: 1989

Purpose: To prevent wasteful water use practices which are encouraged by water rates.

Enforcement: Municipality

Key Provisions:

- As of January 1, 1991, declining block water or sewer rates may not be used by any local body to charge for water or sewer services.

9.0 REGIONAL WATER ACTION STRATEGY

A fundamental task facing the region, as we move into the 21st century, will be to manage the Pioneer Valley's water supply and water demands so that every community will have safe, clean drinking water in sufficient quantity, when and where it is needed. Achieving this goal will require regional cooperation, and new strategies for managing both supplies and demand. The following recommendations lay out a blueprint for cooperative, regional action on water supply management. All of the recommendations contained herein have been adopted by the Pioneer Valley Water Supply Task Force.

9.1 Water Conservation Recommendations

The following strategies are recommended to address regional water conservation policy issues which were described in Section 5.2:

Action Strategy #1: ADOPT CONSERVATION-ORIENTED WATER RATE STRUCTURES AND PRICING POLICIES
(Recommended for all Pioneer Valley communities)

Short-range recommendations:

a. Communities should adopt increasing or uniform block rates, in accordance with state law. These rates should incorporate "lifeline" rates providing an economical rate for basic domestic water consumption volumes;

b. Communities should adopt enterprise accounts for water revenues and costs, and water pricing structures which account for the true cost of providing water;

c. Water conservation measures should be fully funded through the Water Department budget;

Longer-range recommendations:

d. Communities should establish a system for billing water and sewer costs together;

e. Communities should require full metering of all users, preferably using outdoor reading meters;

f. Communities should increase the frequency of billing, preferably to bi-monthly or quarterly, in order to more readily demonstrate the benefits of conservation to individual users. Such bills should illustrate water use over time, for the previous twelve-month period.

Action Strategy #2: CONDUCT LEAK DETECTION AND REPAIR PROGRAMS
(Recommended for all Pioneer Valley Communities)

Short-range recommendations:

a. Communities should establish intermunicipal purchasing agreements to acquire leak detection equipment;

Longer-range recommendations:

b. Communities with existing staff capable of undertaking leak detection should consider the joint purchase, with other communities of geophones, and other leak detection equipment;

c. Communities without existing staff capable of undertaking leak detection should investigate collectively hiring a leak detection consultant;

d. All communities should adopt a policy of conducting a bi-annual leak detection and repair program for entire water system.

Action Strategy #3: PROMOTE NON-DOMESTIC CONSERVATION PROGRAMS
(Recommended for all Pioneer Valley Communities)

Longer-term recommendations:

a. Communities, and the Pioneer Valley Water Supply Task Force, should promote technology transfer between businesses using successful models of local business water conservation. This can be achieved through workshops, presentations and written materials. Trade associations, local Chambers of Commerce, and other user group organizations should be asked to assist in hosting conservation workshops;

b. Voluntary water audits should be encouraged for all businesses;

c. Water suppliers should develop the capability to provide water audits;

Action Strategy #4: ENFORCE AND IMPROVE STATE PLUMBING CODE
(Recommended for all Pioneer Valley Communities)

Short-range recommendations:

a. Communities should direct local plumbing inspectors to enforce state Plumbing Code requirements for low-flow toilets in all new construction and rehab work;

b. The Pioneer Valley Water Supply Task Force should support upgrading state Plumbing Code requirements for industrial conservation, particularly the prohibition of wasteful practices such as once-through use of non-contact cooling water, and establish requirements for low-flow faucets, urinals and showerheads in new construction should be supported.

Action Strategy #5: PROMOTE RETROFIT OF DOMESTIC WATER CONSERVING DEVICES
(Recommended for communities with projected water supply deficits)

Short-range Recommendations:

a. The City Council or Board of Selectmen should adopt a resolution recommending that the Water Department adopt a domestic water conservation retrofit program.

Longer-range Recommendations:

b. The most cost-effective method for promoting retrofit of domestic water conserving devices is door-to-door installation of devices;

c. A less costly, but less effective, method for domestic retrofit is provision of free water conserving devices, which must be installed by the homeowner. This approach is a worthwhile public educational tool for communities;

Action Strategy #6: ADOPT NEW CONSTRUCTION GUIDELINES AND ZONING REGULATIONS
(Recommended for communities with projected water supply deficits)

Short-range Recommendations:

a. Communities should adopt site plan approval bylaws and local sewer codes (or town bylaws) requiring mandatory recycling of industrial/commercial cooling or process water;

b. Communities should adopt site plan approval bylaws which encourage xeriscapes (i.e. landscaping requiring minimal watering), smaller lawns (i.e. 10,000 square feet maximum) and more native landscaping;

c. Communities should adopt cluster residential zoning with provisions for smaller lawns;

d. Communities should adopt local ordinances empowering the municipal Board of Public Works to adopt water hook-up regulations to encourage or require non-potable wells for outdoor or process water use for large-scale users, in cases where on-site wells are feasible. (On-site wells and water systems must be designed to prevent cross-connections with public supplies, and must meet all applicable state and local regulations).

Action Strategy #7: UNDERTAKE PUBLIC EDUCATION PROGRAMS
(Recommended for communities with projected water supply deficits)

Short-range Recommendations:

a. Communities, in cooperation with the Pioneer Valley Water Supply Task Force, should consider undertaking the following educational efforts:

- Promoting the adoption of school curriculums on water conservation;

Longer-range Recommendations:

b. Communities should consider undertaking the following educational efforts:

- Promotion of water conserving practices through media releases and civic group meetings;

- Developing and mailing a water conservation brochure with water bills;
- Promote effective use of outdoor watering in early morning and late evening hours.

Action Strategy #8: RETRO-FIT MUNICIPAL BUILDINGS
(Recommended for communities with projected water supply deficits).

Short-range Recommendations:

a. Where opportunities exist for water conservation in municipal buildings and operations, communities should undertake efforts such as:

- Retrofit of water-saving devices in municipal buildings and schools;
- Ensuring meters are working properly, regular replacement schedule;
- Encourage looping of water distribution system dead ends to eliminate the need for frequent system flushing;
- Reducing outdoor water use for public grounds and fountains;
- Reducing frequency of washing municipal vehicles.

Action Strategy #9: PREVENT WATER DEFICITS
(Recommended for communities with projected water supply deficits).

Short-range Recommendations:

a. Communities should investigate establishment of multi-community water districts, which are enabled under M.G.L. Chapter 361, in order to cooperatively develop new water sources, and undertake water conservation programs.

9.2 Water Supply Protection Recommendations

The following action strategies are recommended to address the regional water protection issues described in Section 7.1:

Action Strategy #1: ADOPT WATER SUPPLY PROTECTION ZONING

a. Communities should adopt water supply protection overlay zoning districts for watershed and aquifer recharge areas, which include:

- Prohibitions on hazardous land uses;
- Special permit/site plan approval processes for all institutional, commercial and industrial uses;
- Performance standards for all uses.

Action Strategy #2: ADOPT REDUCED ROADSALT POLICIES

a. Communities should adopt municipal policies on highway salt application and storage, which:

   - Designate environmentally sensitive areas adjacent to highways and roads to protect aquifers, reservoir watersheds and private wells;
   - Identify "best management" practices for salt application;
   - Prohibit road salt storage in critical areas.

Action Strategy #3: ESTABLISH UNDERGROUND STORAGE TANK AND HAZARDOUS MATERIALS BYLAWS

a. Communities should establish municipal bylaws to require registration of underground fuel storage tanks not registered under state law;

b. Communities should establish municipal bylaws to require registration of the storage of commercial quantities of hazardous materials, and to establish safe storage standards:

Action Strategy #4: DEVELOP LAND ACQUISITION PROGRAMS FOR WATERSHED AND AQUIFER RECHARGE AREAS

a. Communities should support the funding of the State aquifer land acquisition program;

b. Communities should develop local programs for land purchase;

c. Communities should create enterprise accounts for the purpose of purchasing watershed and aquifer recharge lands.

Action Strategy #5: ADOPT PRIVATE WELL REGULATIONS

a. Communities should establish water quality monitoring programs for private wells;

b. Communities should establish septic system maintenance regulations;

c. Communities should establish private well regulations;

Action Strategy #6: ADOPT SUBDIVISION REGULATIONS FOR WATER SUPPLY PROTECTION

a. Communities should establish strict drainage requirements to control drainage and urban runoff impacts on water supplies;

Action Strategy #7: DEVELOP SPILL RESPONSE PLANS

a. Communities should develop monitoring and response plans for hazardous chemical spills and emergencies so that contamination can be avoided and damage limited.

Action Strategy #8: DEVELOP INTERMUNICIPAL WATER SUPPLY PROTECTION DISTRICTS AND COMPACTS

Where aquifer recharge areas and reservoir watersheds extend across municipal boundaries, communities should cooperate in the following areas:

a. Communities should coordinate zoning and other municipal bylaws for water resource protection;

b. Communities should consider establishing Intermunicipal Memorandum of Agreements which:

- Create a process for intermunicipal review of development proposals of regional impact;
- Establish water supply protection advisory committees to monitor and plan for the protection of water supplies.

c. Communities should establish cooperative emergency response plans.

9.3 Intermunicipal Connection Recommendations

Municipalities should be prepared to deal with water shortfalls. Intermunicipal connections and agreements are important tools a municipality can use to meet these shortfalls. Intermunicipal connections and agreements should be established wherever they are possible to prevent disruption to users while the shortfall is corrected.

The following strategies are recommended to address intermunicipal water connection issues:

Action Strategy #1: INVENTORY ALL POTENTIAL EMERGENCY INTERMUNICIPAL CONNECTIONS

Short-range recommendations:

a. Each municipality should prepare an inventory of potential interconnections based on the location of the lines, physical aspects of the line, pipe size, system pressure, adequacy of supply, and water quality compatibility. Municipalities should review and assess this material and select potential interconnections to develop and formalize;

b. Interconnections should be made to intersecting lines from adjacent municipal systems whenever lines are improved, replaced, or expanded.

Longer-range recommendations:

c. Municipalities should adopt a policy to extend lines to town boundaries whenever lines are improved, replaced, or expanded, consistent with long term planning goals for that area. Meter pits and shut-off valves should be constructed at lines end;

d. Designs for future system improvement or expansion should plan for intermunicipal connections. Capital planning should include costs for interconnections.

Action Strategy #2: ASSESS ALL EXISTING EMERGENCY INTERMUNICIPAL CONNECTIONS

Short-range recommendations:

a. Emergency interconnections and any required accessory equipment, such as pumps or chlorinators, should be tested yearly to guarantee that the connection is still operational.

Longer-range recommendations:

b. Municipalities should work together to convert existing temporary connections to permanent connections wherever feasible. This permanent conversion should include the installation of meter pits and shut-off valves;

c. Procedures should be identified for obtaining emergency equipment such as pumps or portable chlorinators which might be needed for each connection.

Action Strategy #3: ESTABLISH INTERMUNICIPAL CONTRACTS FOR ALL EMERGENCY INTERCONNECTIONS

Short-range recommendations:

a. Municipalities should establish formal contractual agreements for all existing emergency connections to ensure relative security in supply;

b. Municipalities should review contracts on a regular basis to ensure the contract meets the needs of the municipality.

c. Each agreement should clearly describe the terms of the contract, how the interconnection is to operate, the cost of water, and procedures for measuring water volume (see Section 4.2 for details).

Action Strategy #4: PLAN FOR A SYSTEM OF REGIONAL EMERGENCY WATER INTERCONNECTIONS

The combined safe yield of the region's central water supply systems totals approximately 234 mgd. The combined approximate average daily demand for these municipalities totals approximately 93 mgd. Including the 3 municipalities served by the Quabbin Reservoir the total average day demand is 107 mgd. If the volume of water is the sole criteria considered then there is a sufficient natural supply within the region to supply all the demands of the region's users. Even if a supply disruption occurs in one part of the region there is ample supply from other parts of the region to meet the regional demand. If a shortfall does occur it is because water is not readily transferred from one area to another in the region. Localized water shortfalls result from regional distribution inadequacies.

Short-term recommendations

a. To avoid localized water shortfalls in the future municipalities should work together to develop a regional emergency water distribution network. This network would provide an organizational means to quickly respond to water emergencies. To be effective this network should include as many municipalities as is feasible;

Longer-term recommendations:

b. A regional body should oversee this regional emergency network. This body should consist of municipal water officials and elected officials. This body may be a newly formed group or may be part of an existing group, such as Water Resources Commission. The Model Mutual Aid Compact, in Appendix C, based on a existing emergency network in North Carolina, offers an example;

c. The following tasks are recommended for a regional emergency water distribution network:

- system hydraulic studies to determine the feasibility of distribution systems, or segments of systems, to provide emergency supplies in sufficient amounts to cover shortfalls;
- technology transfer between municipalities to share results of hydraulic studies. A regional computer systems modeling program should be investigated to provide consistent output and analysis between municipalities and reduce water department operating costs;
- the purchase of emergency equipment such as portable chlorinators or pumps;
- the establishment of permanent emergency interconnections;

d. A funding mechanism, consistent with the establishment of a Regional Emergency Water Distribution Network, should be explored to pay for interconnection costs.

10.0 PUTTING THE STRATEGY INTO ACTION

10.1 Subregions for Action on Water Conservation, Protection and Interconnection

In order to take effective action on the strategies recommended in Section 9.0, Pioneer Valley communities should work cooperatively and in concert with their neighboring communities which share watersheds, aquifers, potential interconnections, and other conservation concerns in common.

The map "Subregions for Cooperation on Water Conservation, Protection and Interconnection" provides a suggested outline for subregional alignments. These alignments are based on shared aquifers or watersheds, existing or potential interconnections, or other shared water supply concerns. In several cases, municipalities may wish to consider participating in more than one subregion.

10.2 Existing Subregion Models

The Barnes Aquifer Protection Advisory Committee (BAPAC) is an existing and effective model for intermunicipal cooperation on water supply issues. BAPAC was established in 1989, through approval of an intergovernmental "Memorandum of Agreement for Barnes Aquifer Protection" by Town meeting, City Council or Board of Aldermen's vote in Westfield, Holyoke, Easthampton, Southampton, and by vote of the Pioneer Valley Planning Commission. The MOA establishes a permanent BAPAC, comprised of three members from each municipality, and one member from PVPC. BAPAC has authority to undertake advisory review of any "development of regional impact" within the Barnes Aquifer, and to forward review comments to local boards suggesting measures to prevent water supply impacts. BAPAC also has authority to assist its four member municipalities in coordinating other water protection strategies, such as zoning controls, municipal hazardous materials bylaws and public education. The Barnes MOA is readily expandable to allow for increasing the member municipalities or broadening the agenda to include other water-related issues.

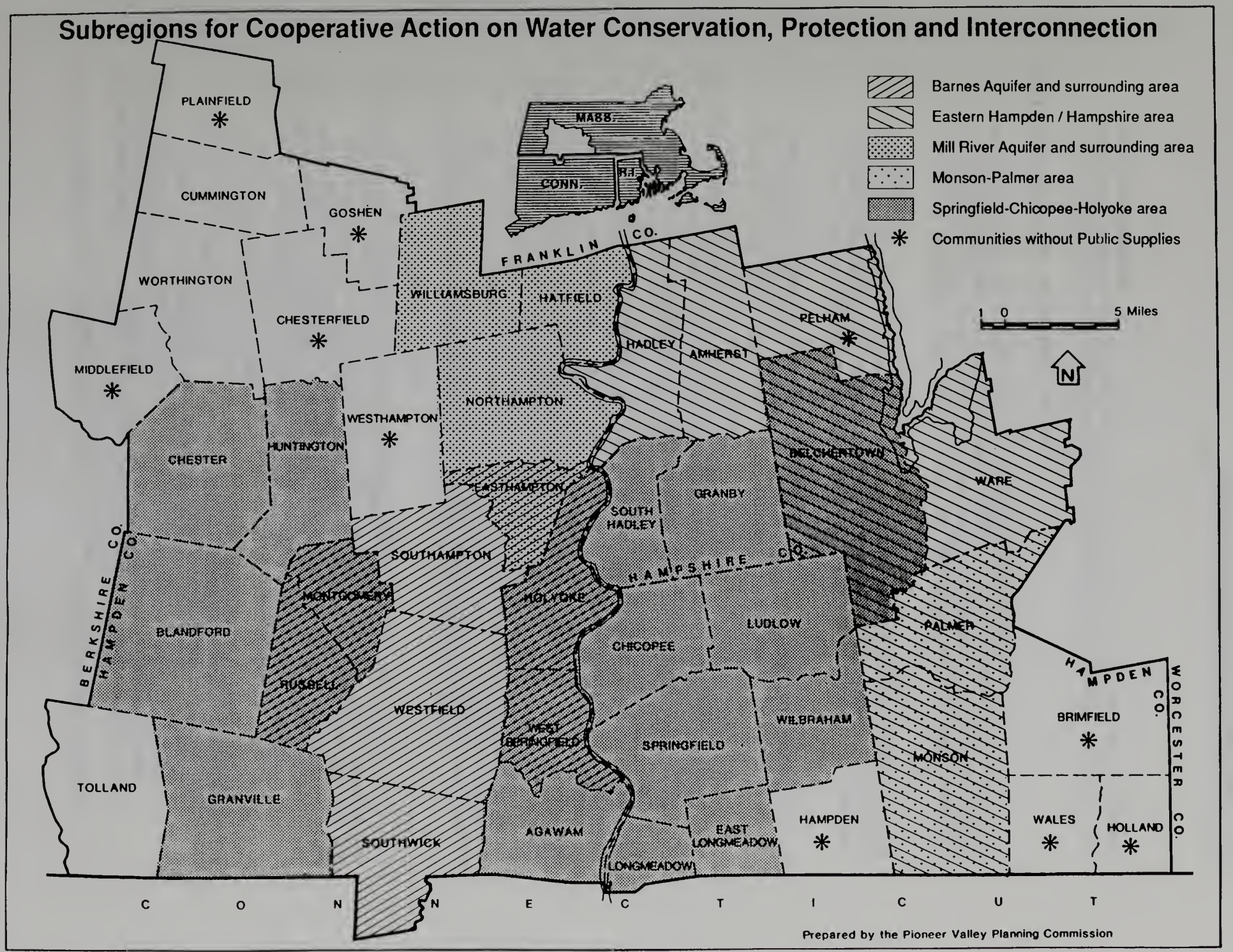
In addition to BAPAC, there are two other subregional water agreements currently under development including the Hatfield-Northampton-Whately-Deerfield subregion, and the Amherst-Pelham-Belchertown-Palmer subregion.

Intermunicipal memoranda of agreement are a useful first step in formalizing subregional alignments of communities seeking cooperation on water supply issues. These MOAs establish a forum for discussion and action on the specific water supply issues facing each subregion.

Eventually, subregions may wish to move one step further and establish formalized "drinking water protection districts" in accordance with Chapter 351 of the Acts of 1989. This step would give the districts greater authority, including the ability to raise funds through a percentage of water revenues in each member municipality.

10.3 Recommended Subregional Actions

Once established, each subregional group will need to set an agenda of issues to be addressed. These issues will be specific to subregional needs but the following issues should be considered:


Subregions for Cooperative Action on Water Conservation, Protection and Interconnection
Barnes Aquifer and surrounding area
Eastern Hampden / Hampshire area
Mill River Aquifer and surrounding area
Monson-Palmer area
Springfield-Chicopee-Holyoke area
Communities without Public Supplies
1 0 5 Miles
N
MASS.
CONN.
R.I.
PLAINFIELD
CUMMINGTON
GOSHEN
WORTHINGTON
CHESTERFIELD
MIDDLEFIELD
WILLIAMSBURG
HATFIELD
FRANKLIN CO.
PELHAM
HADLEY
AMHERST
NORTHAMPTON
WESTHAMPTON
HUNTINGTON
CHESTER
EASTHAMPTON
SOUTH HADLEY
GRANBY
BELCHERTOWN
WARE
SOUTHAMPTON
HAMPSHIRE CO.
BERKSHIRE CO.
HAMPDEN CO.
MONTGOMERY
HOLYOKE
BLANDFORD
LUDLOW
CHICOPEE
PALMER
RUSSELL
WESTFIELD
WEST SPRINGFIELD
SPRINGFIELD
WILBRAHAM
MONSON
BRIMFIELD
HAMPDEN CO.
WORCESTER CO.
TOLLAND
GRANVILLE
SOUTHWICK
AGAWAM
EAST LONGMEADOW
LONGMEADOW
HAMPDEN
WALES
HOLLAND
CONNECTICUT
Prepared by the Pioneer Valley Planning Commission

- Coordination of local water supply protection zoning bylaws;
- Intermunicipal review of "developments of regional impact";
- Land acquisition for water supply protection;
- Intermunicipal purchase of leak detection equipment;
- Public education on water conservation and protection, including school programs;
- Workshops on business water conservation;
- Intermunicipal purchase of water conservation devices for domestic retro-fit;
- Cooperative development of new water sources;
- Intermunicipal household hazardous waste collection centers;
- Legal agreements and logistical arrangements for intermunicipal water connections,

10.4 Recommended Community-Specific Actions

In addition to the regional or multi-community actions previously noted, the following recommendations for action on water supplies are made specific to individual communities (See Section 9.0 for detailed description of each recommended action):

Community	Protection/Conservation Action	Interconnection Action
Agawam	• Enforce state plumbing code • Adopt uniform or increasing block rate • Establish leak detection program	• Consider emergency connections when system expansion or improvement is planned.
Amherst	• Enforce state plumbing code • Adopt water conservation-oriented development regulations	• Develop a permanent connection with Hadley at the Meadow St. site. • Develop intermunicipal agreement with Hadley for the Meadow St. site. • Consider emergency connections with Belchertown when Belchertown's Daigle well is activated. • Consider emergency connections with Sunderland when expansion or improvement is planned. • Further examine the feasibility of connections with Hadley at the Bay Rd. site and Rt. 9 site.
Belchertown	• Adopt UST/hazardous materials controls • Enforce state plumbing code	• Consider an interconnection to the Amherst system when the distribution system is expanded to the Daigle well.
Blandford	• Establish universal metering • Adopt private well regulations	• Develop strategies to deal with water shortfalls, such as storage or back-up supplies.
Brimfield	• Enforce state plumbing code • Adopt uniform or increasing block rate • Establish leak detection program • Adopt underground storage tank/hazardous materials controls • Adopt water supply protection zoning • Adopt private well regulations	

Community	Protection/Conservation Action	Interconnection Actions
Chester	• Establish universal metering Adopt uniform or increasing block rate • Adopt water supply protection zoning • Adopt water protection regulations • Establish enterprise fund • Establish leak protection program • Enforce state plumbing code • Adopt water conservation-oriented development regulations • Adopt underground storage tank/ hazardous materials controls	• Develop strategies to deal with water shortfalls, such as storage or back-up supplies.
Chesterfield	• Adopt water supply protection zoning • Adopt private well regulations • Adopt underground storage tank/ hazardous material control	
Chicopee	• Adopt uniform or increasing block rate • Enforce state plumbing code • Adopt water conservation-oriented development regulations	• Further examine the feasibility of a connection with South Hadley. • Develop interconnection contract with South Hadley.
Cummington	• Enforce state plumbing code • Adopt private well regulations • Adopt water conservation-oriented development regulations	• Develop strategies to deal with water shortfalls, such as storage or back-up supplies.
E. Longmeadow	• Adopt uniform or increasing block rate • Establish leak detection program • Enforce state plumbing code	• Explore potential emergency connections.
Easthampton	• Establish leak detection program • Enforce state plumbing code • Adopt UST/hazardous materials controls • Adopt water conservation-oriented development regulations	• Develop the Northampton St. connection into a permanent connection. • Consider developing another connection with Northampton at Florence Rd. • Consider planning for connections with Northampton in conjunction with Northampton's capital improvement plan. • Examine the feasibility of a connection with Holyoke along Rt. 5.
Goshen	• Adopt private well regulations	
Granby	• Establish leak detection program • Adopt UST/hazardous materials controls • Enforce state plumbing code	

Community	Protection/Conservation Action	Interconnection Action
Granville	• Establish leak detection program • Enforce state plumbing code • Adopt water supply protection zoning • Adopt private well regulation • Adopt water conservation-oriented development regulations • Adopt UST/hazardous materials controls	• Develop strategies to deal with water shortfalls, such as storage or back-up supplies.
Hadley	• Establish universal metering • Establish leak detection program • Adopt UST/hazardous materials controls • Enforce state plumbing code	• Develop a permanent connection and contract with Amherst at the Roosevelt St. site. • Further examine the feasibility of connections with Amherst along Bay Rd. and Russell St. • Establish an emergency connection with Sunderland along River Road.
Hampden	• Adopt private well regulations	
Hatfield	• Adopt water supply protection zoning • Adopt UST/hazardous materials controls • Establish universal metering • Establish leak detection program • Enforce state plumbing code	• Develop an interconnection contract with Whately and Northampton for the existing emergency connections. • Develop permanent connections with Whately and Northampton at the existing temporary emergency connection sites.
Holland	• Adopt private well regulations	
Holyoke	• Adopt uniform or increasing block rate • Enforce state plumbing code • Adopt UST/hazardous materials controls	• Further examine the feasibility of connections with S. Hadley District #1, Chicopee, W. Springfield, Westfield or Easthampton. • Develop an interconnection contract with W. Springfield for the existing emergency connections. • Develop permanent connections with W. Springfield at the existing temporary emergency connection sites.
Huntington	• Establish universal metering for public supply • Adopt UST/hazardous materials controls • Establish enterprise fund • Adopt private well regulations • Adopt uniform or increasing block rate • Establish leak detection program • Enforce state plumbing code	• Further assess the feasibility of establishing an emergency connection with Springfield, and obtain the necessary equipment for that connection.

Community	Protection/Conservation Actions	Interconnection Action
Longmeadow	• Establish enterprise fund • Establish leak detection program • Enforce state plumbing code	• Further assess possible additional connections with the Springfield system.
Ludlow	• Adopt water protection zoning • Establish enterprise fund • Enforce state plumbing code • Adopt UST/hazardous materials controls	• Re-establish an emergency connection with Wilbraham. • Further assess the feasibility of an emergency connection with the Chicopee Valley Aqueduct.
Middlefield	• Adopt private well regulations	
Monson	• Establish universal metering • Establish enterprise fund • Adopt UST/hazardous materials controls • Adopt uniform or increasing block rate • Establish leak detection program • Enforce state plumbing code	• Further assess the feasibility of interconnection with Palmer.
Montgomery	• Adopt private well regulations	
Northampton	• Adopt UST/hazardous materials controls • Establish leak detection program • Adopt water conservation-oriented development regulations	• Establish permanent emergency connections with Hatfield and Easthampton at existing temporary connection sites. • Develop an intermunicipal agreement with Hatfield for the King St. site. • Consider a connection with Williamsburg in conjunction with proposed water system improvements.
Palmer	• Adopt UST/hazardous materials controls • Establish enterprise funds - all districts • Establish leak detection programs - all districts • Enforce state plumbing code • Adopt water conservation-oriented development regulations	• Continue discussions about increased cooperation between the four systems.
Pelham	• Adopt private well regulations • Adopt UST/hazardous materials controls	
Plainfield	• Adopt private well regulations	
Russell	• Establish universal metering • Establish enterprise fund • Adopt water supply protection zoning • Adopt UST/hazardous materials controls • Adopt uniform or increasing block rate • Enforce state plumbing code • Establish leak detection program	• Develop strategies to deal with water shortfalls, such as storage and back-up supplies

Community	Protection/Conservation Action	Interconnection Action
South Hadley	• Adopt uniform or increasing block rate for District #1 • Adopt water supply protection zoning • Adopt UST/hazardous material controls • Establish enterprise fund - District #1 • Adopt water conservation-oriented development regulations • Enforce state plumbing code	• District #1-Establish permanent emergency connections with S. Hadley, District #2, and Chicopee at existing temporary connection sites. • Develop interconnection contracts with S. Hadley District #2 and Chicopee for existing temporary emergency connections. • District #2- Establish permanent emergency connection with S. Hadley District #1 at existing temporary connection sites. • Develop an interconnection contract with S. Hadley District #1 for existing temporary emergency connections.
Southampton	• Adopt private well regulations • Adopt UST/hazardous materials controls • Establish universal metering • Adopt uniform or increasing block rate • Enforce state plumbing code	• Further assess the feasibility of an emergency connection with Easthampton.
Southwick	• Adopt water conservation oriented development regulations • Adopt water supply protection zoning • Adopt UST/hazardous materials controls • Establish leak detection program • Enforce state plumbing code	• Further assess potential connections with Agawam and Westfield.
Springfield	• Adopt uniform or increasing block rate • Enforce state plumbing code	• Further assess potential connections with Chicopee, Huntington, and Wilbraham. • Develop an intermunicipal agreement with Chicopee for existing emergency connections.
Tolland	• Adopt private well regulations	
Wales	• Adopt private well regulations	
Ware	• Establish enterprise fund • Establish leak detection program • Adopt UST/hazardous materials controls • Enforce state plumbing code • Adopt water conservation-oriented development regulations	• Further assess an emergency connection with Palmer-Bondsville.

Community	Protection/Conservation Action	Interconnection Action
West Springfield	• Establish enterprise fund • Adopt UST/hazardous materials controls • Adopt water conservation-oriented development regulations • Adopt uniform or increasing block funds • Establish leak detection program • Enforce state plumbing code	• Establish permanent emergency connections with Holyoke at existing temporary sites. • Develop agreements with Holyoke for existing temporary emergency connections. • Further assess the feasibility of emergency connections with Agawam and Westfield.
Westfield	• Establish universal metering • Adopt increasing or uniform block rate • Establish leak detection program • Enforce state plumbing code • Adopt water conservation-oriented development regulations	• Further assess the feasibility of emergency connections with Westfield and Holyoke.
Westhampton	• Adopt water supply protection zoning • Adopt private well regulations	
Wilbraham	• Adopt water conservation-oriented development regulations • Update water supply protection zoning • Enforce state plumbing code	• Further assess the feasibility of emergency connections with the Springfield Regional System.
Williamsburg	• Adopt UST/hazardous materials controls • Establish universal metering program • Enforce state plumbing code • Establish leak detection program	• Consider a connection with Northampton in conjunction with Northampton's proposed water system improvements.
Worthington	• Establish enterprise fund • Establish universal metering for public supply users • Adopt uniform or increasing block rate • Establish leak detection program • Enforce state plumbing code	• Develop strategies to deal with water shortfalls, such as storage or back-up supplies.

APPENDIX A:

BUSINESS WATER SUPPLY SURVEY AND RESULTS

BUSINESS WATER SUPPLY SURVEY

Pioneer Valley Planning Commission
in cooperation with Pioneer Valley Water Supply Task Force

The Pioneer Valley Planning Commission is conducting a study to determine regional water supply needs, including the needs of businesses. Responses to this questionnaire will be used to update the report **WATER 2000,** to assess the feasibility of business water conservation practices, and to formulate regional water conservation strategies.

BUSINESS RESPONDING _____
PERSON RESPONDING _____

1. Please describe the type of product or service your business is involved in:

   _____

2. What is the source of water for your business?

Municipal supply	34	81 % of total
On-site wells	8	19 % of total
Other	0	0 % of total

3. How much water does your business use?
   569,000 gallons per day (average)

4. What type of water uses are included in your business operations?
   Cooling 10-primary use % of total
   Process 8-primary use % of total
   Domestic uses 27-primary use % of total
   Other 1-primary use % of total

5. Do you anticipate your business' water demand will change in the next ten years?
   11 - Demand will increase _____% of increase
   19 - Demand will decrease _____% of decrease
   16 - Not Sure
   6 - Same Level

6. Has your business performed a water audit (to determine where water is being used within the business and how cost-saving conservation measures can be employed)
   15 - Yes No - 27
   If not, would you consider having a water audit performed?
   21 - Yes No - 5 4 - Not Sure

7. Has your business utilized any of the following water conservation measures?

   3 On-site non-potable wells for process water or outdoor landscape watering
   21 Recirculation of cooling water
   16 Recycling of process water
   4 Consolidation of water-using operations
   6 Water restrictors on process equipment
   11 Automatic shutoff valves or faucets on process equipment
   8 Retro-fitting low-flow toilets or faucets for domestic uses
   22 Leak detection and repair
   4 Other (specify) water restrictors on showerheads, restrict outdoor watering, condensate return, water tower.
   9 None

8. Would you be willing to consider retro-fitting your business with water conservation devices and measures if it can be shown that the devices/measures would pay for themselves with a modest period of time (i.e. one year)

   25 - Yes 2 - No 15 - Not Sure

9. Would you be interested in attending a workshop with presentations from companies who have successfully saved money be installing water conserving devices and procedures?

   29 - Interested 8 - Not Sure 5 - Not Interested

APPENDIX B

MODEL BYLAWS FOR WATER CONSERVATION

MODEL SITE PLAN APPROVAL BYLAW FOR WATER CONSERVATION

(Must be adopted by 2/3 majority vote of Town Meeting or City Council)

The following bylaw language is suggested as an addition to an existing municipal site plan approval bylaw. The full text of a model site plan approval bylaw is contained in the PVPC publication, The Growth Management Workbook.

1. Amend the "Required Site Plan Contents" section to include the following item:

   a. The anticipated volume of municipal water to be used (in gallons per day), a description of all water uses (i.e. cooling, process, domestic), and a description of all water conservation measures and any on-site wells to be used.

2. Amend the "Site Plan Approval Criteria" section to include the following item:

   a. The proposed development, to the maximum extent feasible, is designed to conserve water use, and meets all water conservation performance standards in this bylaw.

3. Amend the "Site Plan Approval Performance Standards" section to include the following:

   a. Water Conservation and Recycling

      1. All new commercial car-wash facilities shall be equipped with an approved water recycling system on both the wash and rinse units. Replacement of car-wash equipment in existing facilities shall also be equipped with such recycling systems.

      2. All non-contact cooling water for business or industrial use shall be recycled.

      3. All toilets shall meet low-flow standards in accordance with the Uniform State Plumbing Code.

      4. All faucets, showerheads and urinals shall meet the following low-flow standards:

Shower heads	1.0 g.p.f.
Urinals	2.5 g.p.m.
Lavatory Faucets	2.0 g.p.m.
Kitchen Faucets	2.5 g.p.m.

      5. Landscaping plans shall incorporate the maintenance of existing on-site trees, plants and shrubs to the extent feasible. In new landscaping, preference shall be given in planting selection to native, low water use plants such as the following:

Trees	**Annuals/Biennials**
Amur Maple	Cosmos
Austrian Pine	Gazania
Japanese Black Pine	Marigold
London Plane	Portulaca
White Oak	Strawflower
Shrubs	**Perennials**
Broom	Aster

Flowering Quince
Junipers
Potentilla
Salt-Spray Rose

Ground Covers
Bearberry
Lilies of the Valley
Violets
Pachysandra
Myrtle
Ajuga
Creeping or Blooming Thyme
Creeping Phlox
Creeping Ivy

Common Blanketflower
Sedum (Acre, Red Carpet, Ruby Glow, Stoliniferum, Spectabile)
Tawny Daylily
Yarrow
Daisy
Hosta
Blackeyed Susan

Prior to landscaping, soils shall be prepared with organic matter to increase water retention capabilities. Areas with planted turf should not exceed a slope of 3:1.

MODEL CITY ORDINANCE OR TOWN BYLAW FOR WATER CONSERVATION

(Adopted by majority vote of Town Meeting or City Council; town bylaws must be approved by the state Attorney General, city ordinances do not need Attorney General's approval)

The following language is suggested as an addition to city of town ordinances regarding connection to public sewer or water systems:

1. Connection to Public Water and Sewer Systems.

No person shall be issued a written permit to make a connection to a public sewer or water line unless the following performance standards have been met:

a. Water Conservation and Recycling

1. All new commercial car-wash facilities shall be equipped with an approval water recycling system on both the wash and rinse units. Replacement of car-wash equipment in existing facilities shall also be equipped with such recycling systems.

2. All non-contact cooling water for business or industrial use shall be recycled.

3. All toilets shall meet low-flow standards in accordance with the Uniform State Plumbing Code.

4. All faucets, showerheads and urinals shall meet the following low-flow standards:

Showerheads	1.0 g.p.f.
Urinals	2.5 g.p.m.
Lavatory Faucets	2.0 g.p.m.
Kitchen Faucets	2.5. g.p.m.

APPENDIX C:

MODEL MUTUAL AID COMPACT

MODEL MUTUAL AID COMPACT
(Based on a compact developed for Region J, North Carolina)

JOINT RESOLUTION
ESTABLISHING COMMON LOCAL POLICIES FOR MUTUAL AID DURING WATER SUPPLY EMERGENCIES IN THE PIONEER VALLEY

WHEREAS, the 1990 Pioneer Valley Water Supply Task Force expressed a broad based commitment to specific actions for enhancing the economic, environmental, and human resources of the cities and towns comprising the Pioneer Valley and:

WHEREAS, utility infrastructure with sufficient capacity and reliability is essential to the promoting the well-being of the Regions residents;

WHEREAS, the governing bodies of the parties to this Resolution recognize an increasing interdependence of water supply, development, and disposal activities expressed by the phrase "We all drink from the same bowl;" and

WHEREAS, the increasing number of interconnections between local water systems provide the basis of a larger, more coherently planned water supply network; and,

WHEREAS, such interconnections should be designed to meet water supply needs ranging from short term emergency service measured in days; to seasonal drought supplements lasting for weeks or months; to longer duration transfers capable of satisfying interlocal water supply needs over a period of years; and,

WHEREAS, the Region's overall water resources are sufficient to meet most foreseeable local emergencies without undue hardship on neighboring water systems within the Region; and,

WHEREAS, an important element of the Region's high quality of life is the diversity and uniqueness of its individual communities, with those identities often expressed through different philosophies of growth, development, and capital facility expansion.

NOW THEREFORE, the governing bodies of the parties to this Resolution having determined that the public health, safety and welfare will be served and benefited by their cooperation as hereinafter set out; and, in the desire to assure adequate service during temporary disruptions caused by failure of the water supply, treatment, or transmission/distribution systems of any of the parties, do mutually resolve as follows:

1. COOPERATIVE INTENT

The parties to this Resolution intend to proceed cooperatively in utilizing water resources and facilities to support their respective service areas, and upon future mutual agreement, to enter into such joint administrative, financial, engineering or construction ventures which the individual parties determine support the best interests of their constituencies in assuring a reliable, high quality water supply during short term emergencies as defined herein.

2. ADDITIONAL INTERCONNECTIONS

The parties agree the emphasis should be given to creating or enlarging interconnections between water systems in the Region in order to provide for water transfers under short term emergency conditions;

3. WATER SUPPLY EMERGENCIES

The parties intend to establish mutual policies and practices for satisfying water supply needs during unanticipated disruptions of a short term emergency nature, such as those caused by human error, equipment failure, chemical contamination, fire, flood, or other disasters.

For the purpose of this Resolution, "short term emergency" shall mean a period of not more than seven days.

It is not intention of the parties to this Resolution that these policies and practices be construed to apply to water transfers for meeting seasonal drought or longer term interlocal water needs, unless specified upon separate mutual agreement of the parties.

4. ACTIVATING AND EMERGENCY TRANSFER

Any water transfer needed to meet a short term emergency, as described above, would be activated by the chief administrative officers of the entities involved. They shall immediately notify their respective governing boards that such an emergency exists. Any emergency transfer lasting longer than seven days shall require approval by the governing boards of all parties to the transfer.

5. CORRECTING THE EMERGENCY PROBLEM

The part experiencing the water emergency agrees to act expeditiously and adequately to mitigate and remove the causes of the emergency condition. Other parties do hereby agree to offer operational assistance to the affected party in correcting the emergency condition.

6. PRICE OF WATER DURING EMERGENCY

Unless otherwise specified by existing agreements, the price of water transferred during a short term emergency shall be the same as the commodity rate charged to residential customers within the provider's own regular ("inside") service area. It is understood that the party experiencing the short term emergency (the ultimate receiver of water) shall be responsible for paying any excess costs incurred by other parties (providers) the transfer. These costs may include special operational assistance, as described in Section 5; start-up activities, such as line flushing, valve switching, excess pumping or other operational costs attributable to the transfer; and, may include any difference in commodity rates paid by an intermediate provider for water transferred through its own system.

7. PERIOD OF AGREEMENT

This Joint Resolution shall become effective on December 1, 1990, and continue for a period of five years therefrom.

This Joint Resolution may be extended upon mutual agreement of the parties.

IN TESTIMONY WHEREOF, THE UNDERSIGNED PARTIES:

Original text will include a signatory line for each participating entity.

APPENDIX D

SUPPLY AND DEMAND SUMMARY AND PROJECTIONS

Supply and Demand Summary and Projections

A water supply and demand summary has been prepared for each community containing data on total population, population served by public water, per capita consumption, average daily demand, maximum daily demand, and safe yield of supplies.

This data was developed using the following sources and procedures:

Population: - The 1980 population was obtained from the U.S. Census Bureau. The 1988 population was taken from either the 1988 U.S. Census Bureau estimates, the population figure reported on the D.E.P. Division of Water Supply Community Public Water Supply Statistics form, or a 1988 local town census. The 1995 projected population was obtained from the Massachusetts Institute for Social and Economic Research. The 2000 projected population was developed by the Pioneer Valley Planning Commission.

Percentage of Population Served: - This figure represents the best possible estimate of population served by public water presently and in the future. This data was obtained from municipal water departments, private water companies or D.E.P. Water Supply Statistics Forms, 1988.

Per Capita Consumption: - Total annual municipal consumption figures were obtained from the Department of Environmental Protection for 1988. Total consumption was divided by 365 days and then divided by the total population served (i.e., GPCD = gallons Per Capita Per Day).

Average Day Demand - Per capita consumption was multiplied by the population served in 1988 and the population projected to be served in 1985 and 2000 to obtain the Average Day Demand (ADD). It should be noted that these projections are based on population growth only and do not attempt to take into account any possible large-scale industrial or commercial growth. Future consumption was assumed to be the same as 1988. Where 1988 per capita consumption decreased from 1980 an average of 1980 and 1988 consumption was used for projections.

Maximum Day Demand: - The 1988 Maximum Day Demand (MDD) figure was obtained from D.E.P. Community Public Water Supply Statistics for 1988. Based on the 1988 figures a MDD/ADD ratio was developed (see below). The 1995 and 2000 Maximum Day Demand estimates were projected by multiplying the 1995 and 2000 projected Average Day Demand by the MDD/ADD ratio.

MDD/ADD Ratio - The 1988 Maximum Day Demand figure was divided by the 1988 Average Day Demand figure to obtain a ratio. This ratio was assumed to be constant for each municipality and was used to develop the 1995 and 2000 Maximum Day Demand figures used in this report.

Safe Yield: - These figures represent the best available estimate of the applicable municipal water department or private water company. Safe yield is generally calculated for surface water based upon drainage area and reservoir storage area. Safe yield represents the amount of water which can be safely drawn from a source during drought conditions. For groundwater, safe yield is generally calculated by multiplying transmissibility by available water by a safety factor.

Surplus or Deficit: - Surplus or deficit figures were calculated by subtracting either Average Day Demand or Maximum Day Demand from Safe Yield. For communities which receive 50 percent or more of their water supplies from surface reservoirs, Average Day Demand was subtracted from

Safe Yield. For communities which receive 50 percent or more of their supplies from groundwater wells, Maximum Day Demand was subtracted from Safe Yield because groundwater sources do not have sufficient storage capacity to meet maximum demands.

Total Population which could be served by 1988 safe yield: -1988 safe yield was divided by 1988 per capita consumption to determine the total number of residential users which could be served by the 1988 safe yield.